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**A THOUSAND DAYS IN
THE ARCTIC**

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JACKSON AND ARMITAGE ON THEIR SLEDGE JOURNEY (1897)

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A THOUSAND DAYS IN THE ARCTIC

BY

FREDERICK G. JACKSON

KNIGHT, FIRST CLASS, OF THE ROYAL ORDER OF ST. OLAF ; GOLD
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WITH PREFACE BY

ADMIRAL SIR F. LEOPOLD McCLINTOCK

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ILLUSTRATED FROM PHOTOGRAPHS BY THE AUTHOR AND
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FROHAWK, FROM DATA FURNISHED
BY THE AUTHOR

WITH FIVE ORIGINAL MAPS

IN TWO VOLUMES

VOL. II

LONDON AND NEW YORK
HARPER & BROTHERS
45 ALBEMARLE STREET, W.

1899

Slav 3280.24.5

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A THOUSAND DAYS IN THE ARCTIC

CHAPTER XXII

THE BRITISH CHANNEL AN OPEN SEA

March 18th, 1896, Wednesday.—An improvement in the weather occurring, Armitage, Blomkvist, and I left Cape Flora at 11 A.M.. The doctor and Fisher accompanied us till 2 P.M., when we were a little to the north of Windy Gully, where we stopped to make tea and to have a little lunch. It was then discovered that one of Blomkvist's ski, which had been lashed on the last sledge had come adrift; so I went back about a mile accompanied by the doctor and fetched it. The temperature has fallen to -5° F. below zero to-day. Neither the dogs nor the pony have shaped as well as they did yesterday. The pony perspires a good deal and is evidently in soft condition although she looks well. I had great trouble in getting either her or the dogs along, and spent my time after lunch in running backwards and forwards from one team to another, urging on each in turn.

The ice in Miers Channel is fairly level, but deeply covered with snow which is very soft. I intend to follow our course of last spring, and to extend our discoveries northwards.

We camped at 5.30 P.M. having travelled about seven

miles in six and a half hours. We tied both the dogs and pony up to the hummocks. Temperature at camping time was -16° F. below zero.

March 19th, Thursday.—After rather a sleepless night, for both the pony and the sixteen dogs got loose, and turned us out twice to secure them, we tumbled out at 7 A.M. and got breakfast. The minimum thermometer showed -26° below zero during the night and things look better.

We got under weigh at 11 A.M. going over level ice, but with snow lying very soft and deep. Every now and then we came upon rows and fields of hummocks which required careful navigation to avoid smashes.

At 5.30 P.M. we camped in Nightingale Sound with Camp Point bearing about two miles to the south-east of us. Our pony "Brownie" is still going very badly, but the dogs have somewhat improved, but both teams were very tired when I gave the order to camp.

It has been calm all day with thick mists and clouds (str. & r.c.) coming up from the southward. Travelled by compass north 41° east (true). Passed a fox track.

March 20th, Friday.—Thick, overcast and snowing when I called the others at 6.45 A.M.

Got under weigh at 9.45 A.M., passing through hummocky ice with deep snow between the hummocks. The gale in September which so smashed up the ice off Cape Flora evidently broke this up. The weather very thick with falling snow and mist, making it difficult to pick a way, and there being no shadow it rendered it often very hard to distinguish rises from depressions; in fact we marched on in a semi-blind condition, so much so that it was difficult to see the snow upon which we walked, and everything was blurred and indistinct. Our dogs are going better.

Course N. 41° E. (true) nine miles (geographical).

March 21st, Saturday.—We found that a she-bear and cub had passed within a few yards of our camp in the night, but without stopping for a moment. They had not disturbed the dogs who had their noses tucked under their tails owing to the driving snow and wind.

I called the others at 7 A.M., and we were under weigh at 11 A.M. A beautifully fine, clear, and calm day for these parts. I could clearly make out soon after starting the outlines of Northbrook Island, Hooker Island, the northern portion of Bruce Island, and a part of the coast of the land to the west. Eaton Island also was well in view. I stopped and took a round of angles, and roughly plotted them in my sketch-book. On stopping at 2 P.M. for lunch we were about three miles off Eaton Island (about N.N.W.). The large square bold Rubini Rock (basaltic) near our dépôt made in April 1895 on Hooker Island stands out very boldly and makes a splendid landmark. We crossed several tracks of bears in the afternoon. We camped at 6 P.M. about two miles from Eaton Island, it bearing about W.N.W. A mist coming up from south-east prevented my taking further angles. We are in the best of spirits, everything promises well for our reaching a high latitude, as circumstances now look so much better.

Course N. 45° E. Distance nine miles (geographical).

March 22nd, Sunday.—Such good weather could not last, and as morning broke it was blowing a fresh wind from south-east with a good deal of snowdrift.

I called the two others at 6.45 A.M., and we were under weigh at 9.45. Soon after noon the wind fell and light airs came from the northward. On stopping for lunch, magnetic west of the large, isolated Rubini Rock, and about three miles to the west of Scott Keltie Island,

I took bearings of all important points visible, and made a rough sketch.

Travelled first over hummocky ice with a good deal of deep snow, and then upon level ice also covered with pretty deep snow. Soon after starting after lunch I saw something dark lying upon the ice, and knowing that it could be nothing else than a seal, I called Armitage, and we started off with our rifles to stalk it. We stealthily crept along looking forward to a shot, and fresh meat—seal is nice and tender. On approaching to within forty yards very well satisfied with ourselves at getting up to our game without disturbing it we fired, and then found that it was a seal indeed, but an already dead one!

It was a large ringed seal, and had evidently while sleeping on the ice got frozen out of its hole, and when nearly dead had been worried to death by foxes, the tracks of which were plentiful around, but no bear had been near strange to say. The head and back flippers had been gnawed and had been bleeding, showing that they had been injured before death, and there were many marks of blood around. I placed the carcase on a sledge, and on camping at 5.50 P.M. cached it under a pile of stones upon a small stony island near the north-west end of Scott Keltie Island.

To-night I can see a dark outline of what looks like land to the west of here, but it is very indefinite.

The pony's shoulders are getting much galled by the harness.

Course N. 45° E. Distance about nine miles. Misty generally, but clearing occasionally at various points.

March 23rd, Monday.—Four dogs got loose in the night, and roused us out twice. After a hard day, and having got warm and comfortable in one's furs it does

not put one in the sweetest of tempers to be woke up and have to turn out into the cold again. Before we could stop them they had on the second occasion pulled open a bag of dogs' meat and eaten up ten pounds of it, finishing up with a dessert off one of Blomkvist's old felt boots!

We turned out at 6.30 A.M., and got under weigh at 9.30 A.M. Course north, 61° east towards the bold headland, Cape Albert Markham, but going about two miles outside of it.

Soon after starting the pony and I floundered into an open crack about thirty inches wide, slightly bridged over with snow, and with water just underneath it. I pulled "Brownie" out without much difficulty, but I got wet above my knees, soaking my fur boots, socks, and breeches, the latter of which I shall not be able to get dry again for days, and the boots not until we get back to the hut. (Temperature, -13° below zero.) How water remains unfrozen at this temperature is a mystery to me. The current must be exceedingly rapid. The ice measured two feet one inch, with nine inches of snow over it. The floe is dead level, with hardly a lump of ice upon it for miles. It can only have recently become frozen over. There must be, I think, a very strong current setting from the N.N.W. towards Scott Keltie Island. If we only get flat floes like this, and they become a little more solid, we shall push north in fine style.

I took two bearings before leaving camp, as the mist lifted a little to the northward; and I could also very dimly make out land to the west of us, which appears to terminate at $352\frac{1}{2}^{\circ}$ (magnetic) from our camp, with a broad channel of water to the north communicating with the sea beyond.

At 1 P.M. I again stopped and took bearings, and made a sketch; and then altered our course to north 46° east (magnetic) north 63° east (true).

At 2 P.M. we stopped for lunch. The mist partially lifted to the north and north-east, showing apparently an island, which we had previously suspected, with much water to the west. I decided to make for the western extreme—a low point apparently—as it would take us nearly true north, and would thus save some distance, and we should explore new country. I considered it better for these reasons to take a new course in preference to following last spring's route north-east into Robert Peel Sound.

A bitter wind sprang up from south-east, occasionally chopping right round to north-west, with some snow drift. Our course lay across a very level flow, and at camping-time at 6 P.M. I found some difficulty in discovering a suitable hummock to tie the pony and dogs up to. The ice so far is much more level than last year. Near Scott Keltie Island and Cape Albert Markham we found the ice very boggy and rotten, and I saw many flocks of dovebies flying from the neighbourhood of Rubini Rock towards the N.N.W. There must be water out there.

From 10.30 to 1 P.M. N. 61° E. (true), four miles.
1 P.M. to 2 P.M. N. 63° E. (true), two miles. 2 P.M. to 6 P.M. N. 21° E. (true), four miles. Total, ten miles (geographical).

March 24th, Tuesday.—I called Armitage and Blomkvist at 6.30 A.M., and cooked breakfast, as I always officiate as cook. I first put some snow in the pot to melt, and then put on the oatmeal to cook. During the time this is going on I have a wash in a tea-cupful or so of water, stripping to the waist, which I

invariably do every morning, and then make tea, added hot water to the dried soup, and fry some bear meat. This completes our *menu* for breakfast, which soon disappears before the sledging appetites of three hungry men; and we turn out into the bitter wind and snow outside to pack up. Blowing freshly from the south-east, with a good deal of drift. We packed up under some difficulty, and continued our course round the western side of Koettlitz Island, travelling N. $4\frac{1}{2}^{\circ}$ E. (N. $21\frac{1}{2}^{\circ}$ E. true). The floe was very level and the snow surface good; the wind, which was now blowing at force 6 to 7, helped us along, and we made about two miles per hour.

About 2.30 P.M., having made seven miles (geographical), we stopped for lunch near the coast, a quarter of a mile distant. The wind was now blowing a moderate gale, with the snow drifting thickly, and prevented us seeing more than fifty yards except at intervals. Tea-making for lunch we found rather difficult work. Seeing a spit running out to the northward of us, we struck north (true) to round it. We soon came upon very hummocky ice, indicating great pressure.

At 6.20 P.M. we camped at the end of the spit, having come seven and a half geographical miles since 2.30 P.M.

The wind dropped as we got to camp, but woke up again about 7.30 P.M., preventing an observation of the moon for latitude, which we had intended to take.

Koettlitz Island has ridges bare of snow to a certain extent on this side, covered with water-worn basaltic boulders. There is also a certain amount of vegetation. The plateau is about fifty feet high at the sea edge, and is evidently a raised beach.

(1) Course N. $21\frac{1}{2}^{\circ}$ E., seven miles (true). (2) Course N. (true), seven and a half miles.

We had passed a southern spit of the island without seeing it.

March 25th, Wednesday.—We made a cairn with stones upon a boulder at the end of the spit, about a hundred and twenty yards from the sea and the edge of the slope, and deposited a record and Jack in a tin amongst the stones.

[Copy.]

“THE JACKSON-HARMSWORTH POLAR EXPEDITION.

“Three members of the above Expedition reached this spot on the evening of March 24th, 1896. We are one week out from ‘Elmwood,’ and are pushing north.

“A. B. ARMITAGE.

“K. BLOMKVIST.

“FREDERICK G. JACKSON,

“Commanding the Expedition.”

“We are intending to make for land bearing N. 6° W. (true) from here.”

This record is written in ink upon green waterproof paper, and the small cairn in which it is concealed stands upon a large boulder.

Writing in the tent when sledging is not exactly a joy, especially with ink which is frozen hard, and has to be thawed out by holding the bottle in the hands. The writing must speedily be carried on, or the ink freezes on the pen and on the paper before the sentence is completed. The hands have to be frequently thrust into the pockets to avoid frost-bite, and one feels very thankful when the operation is over.

On reaching the top of the spit or raised beach, fifty feet high, the mist partly lifted and enabled me to take some bearings of the land to the west of us; but the view was rather unsatisfactory. If only one could see

properly, mapping and travelling would be much easier and pleasanter. I also took bearings of the land around Markham Sound, and that to the N.N.E.

After making the cairn and photographing it and the camp, we proceeded round the spit N. 19° E. (true), leaving at 1 P.M., passing through very hummocky ice near the island. On striking across the ice about half a mile from the island we came across a wide crack ten to twelve feet across, only partly frozen over, and with water standing in it. This, together with what looks very suspiciously like a water sky to W. and N.N.W. makes me feel sure there is a lot of water out there. I feel very uneasy about this water. An open sea would frustrate all our plans. We are equipped for sledging, not for boating, which is impossible at this time of the year; and water will stop us. However, I trust it may not be such as will affect us materially. The dog team with Armitage and Blomkvist were got over safely, with only their feet going through the crust of snow over the water; but with the pony I had more trouble, and had to take her out of the sledge and pass a line round her neck to drag her over, and then hauled the sledges over singly. At 2.30 P.M. we stopped for lunch, and I again took angles. We had come three and a half miles (geographical).

After lunch we came upon level ice, and struck N.N.E., just to the west of Cape Fisher. At 6.30 P.M. we camped at a ridge of hummocks, having come seven miles since lunch time.

A black sky to the west, south-west, north-west and north, together with the flight of many flocks of birds towards those points, look very suspicious of open water in those directions. I trust it is a long way off, and will enable us to round Cape McClintock.

Courses, N. 19° E., $3\frac{1}{2}$ miles (geographical). N. 5° E., 7 miles (geographical). Total made good, $10\frac{1}{2}$ miles.

Our small supply of whisky (the water portion of it) has been more or less frozen for some days.

March 26th, Thursday.—We had hardly proceeded in the dense mist and snow half a mile to the northward, when we came upon an open sea of water running right across our path from the south-west and in towards Cape Richthofen. I have removed the peak from the map, as such does not exist, but have named the cape after Richthofen. Our fears of yesterday are now more than confirmed, and our way directly north is entirely blocked.

We now followed the edge of the water to endeavour to get round it, and this led us about south-east; but owing to the very dense mist and falling snow we could not see fifty yards ahead of us, and as there was no sky or wind, only a snowy pall above us, and a dim misty white circle around us; it was very difficult to steer a direct course. The three of us were too fully engaged in hauling and tugging at the sledges and in persuading our animals to push on through the soft deep snow, to spare any one to go ahead with a compass.

After stopping to make a pot of tea at 3 P.M. I tried the pony snow shoes we had constructed at the hut, and find that she goes very much better in them. Blomkvist and I also put on our snow shoes, which we had previously not used much.

At 7 P.M. we camped in a bay with a bold headland bearing 334° (magnetic), which, on the mist lifting later on, proved to be Cape Richthofen and the bay Alec Tweedie Bay,* for we had been wandering practically blindfolded all day. Numerous flocks of dovebies and

* So named by me after Mr. Alec Tweedie.

rotches are continually flying north towards the open water.

Courses :—Various. Travelled twelve miles (geographical).

March 27th, Friday.—On turning out at 5 A.M. to look round, the land on all sides was very distinct. So

OUR CAMP IN ALEC TWEEDIE BAY, CAPE RICHTHOFEN IN DISTANCE

I took a number of photographic negatives and bearings, and made sketches. Distant snow-covered land is visible beyond the south-east entrance to Markham Sound, the northern point of which I have named Cape Paterson.

We packed up and pushed across the floe towards the cape, my intention being to round it, and go eastwards across the bay to the north of it, and by pushing through one of the fjords on the east side, to get round the water, and thus continue our journey north.

Soon after leaving camp we passed several cracks with water standing in them, about three feet to four

feet wide, reaching from the shore away to the westward as far as the eye could see, and thinly bridged with snow. These gave us some trouble in getting the pony and dogs over; the snow, being very soft and deep, made the going bad.

On approaching the Cape I saw at a distance a glacier

CAPE PATERSON

From a Drawing (from a Photograph) by H. Fisher

face with perpendicular dirt striations in it, so I left the sledges and taking my camera took several negatives of it, as it struck me as being very remarkable. There is nothing like a photograph to convince people. On nearing the cape we came upon crushed up ice, and a little further on got upon thin bay ice of only a few days formation.

On getting round the front of the cape we suddenly came upon open water, lightly skimmed with bay ice here

and there, running right round it, up to the glacier face and cutting off our way north. From the land the edge extended at first north-west and then apparently west. Seeing that the next thing to be done was to investigate the extent and direction of the water I turned our teams round, as we were upon thin bay-ice with a wet, soft efflorescence upon it, and pitched our camp close to the land on the east side of the cape near where the glacier face begins.

Having had some food Armitage and I ascended the cape by the glacier to get a look round, finding it to be 700 ft. by aneroid. (Temperature at sea level was 3° below zero and 4° below zero on the summit.)

To our great surprise on reaching the top we found that the water is of very great extent—a perfect sea, in fact—and extends through south-west, west, north-west, and north as far as the eye can reach, and without any ice in it to be seen but thin bay-ice here and there, perhaps an inch thick with streams of water between the patches, and one solitary berg, apparently aground, near Cape McClintock. The water reaches from the glacier face below the Cape, and washes the high precipitous face of the glaciers on the western shores of the British Channel, all the ice having evidently been driven to the northward by a south-east gale. No King Oscar or any other land of any size can lie in that direction or it would hold the ice.

It is evidently quite out of the question to go further north in this direction. And this together with the experiences of last spring satisfy me that I shall have to find another route north, as this land is evidently only an archipelago of islands, and the continental mass that the maps portray vanishes into thin air. It is very disappointing thus to have one's plans upset

by the fallaciousness of what were considered as facts.

I took bearings of all important points, and as the sun was in the west and the horizon clear it showed up the land to the west very plainly. I could make out another island to the north of the land previously seen and a very distant island west of that, about forty-five miles off.

Nothing approaching "mainland" can be seen either west or north-west, and only insignificant islands can be seen to the north. Probably one is the western of the three islands seen last spring. A boat at this time of the year would be quite useless for pushing on, for in a very short time it would become frozen into ice over which one could not walk, and through which a boat could not sail.

I am disinclined to follow Payer's track up Austria Sound unless I can pass his furthest point considerably, which I can hardly expect to do this spring, especially with so much water about and a water sky in the direction of Austria Sound indicating open water there. The most I can hope to do in Austria Sound is to correct or confirm Payer's map, the former of which I did not come here to do, and which, to say the least, is a very unsatisfactory task, and one for which we shall receive no thanks, but rather the reverse, and the latter is unnecessary. I consequently have the greatest objection to following Payer's footsteps. I fear the folk at home will feel disappointed about this—I know I do. I mean to try to explore the country in the neighbourhood of McClintock and Brady Islands, and then strike west and map in the country to the north of Peterhead. By trying Austria Sound we shall probably be stopped by water in such an unfavourable season before we reach Cape Fligely, and will then

accomplish nothing. My companions quite agree with me.

I believe there is a feasible way north through here for a ship, and I hope to take the *Windward* through the British Channel this summer, and round by Cape Mary Harmsworth, in which way a great deal can be done in a very short space of time and with little risk to the ship.

I got the fingers of both hands a good deal frozen while taking bearings, sketching, and using my camera on the summit, for to do these things quickly and well bare hands are necessary. A gale of wind was blowing up there, although only a gentle breeze was moving on the ice below. An ice-dome of not more than fifteen hundred feet, sending down a glacier into the small bay by the aluminium boat depôt, rises from behind some rocks in the bay east of this cape.

Richthofen Peak should be situated here, rising five thousand feet, but none of us can see it!

Payer probably mistook a cloud with the sun shining behind it for a mountain, and banks of mist or the land he has wrongly mapped in. In the Arctic, where mists lie very low, and owing to the very cold atmosphere are often very sharply defined, this mistake is easily made, and I have myself seen a cloud looking so much like land that I have gone into the hut to get my camera to photograph it, to enable people at home to see how much it sometimes simulates land, but on the occasion to which I refer it had so altered in appearance on my return as to be valueless for the purpose. Payer has done most excellent work in Franz Josef Land, and but for the courage, hardihood, and perseverance of himself and his companions, Franz Josef Land would remain

within that dark area of the Polar regions marked "unexplored" on our maps. Both Mr. Leigh Smith and I—and I am sure I may add his name to my testimony—owe what we have been able to add to science and the knowledge of the world here to Weyprecht and Payer's adventurous voyage in the *Tegethoff*, and to Payer's plucky sledge journeys.

CHAPTER XXIII

WE DISCOVER NEW LAND

March 28th, 1896, Saturday.—A bear approached the camp at 3 A.M. and the barking of the dogs turned us out. He however got scared and cleared out. At 8 A.M. while I was cooking breakfast he returned, and although I knocked him over three times with shots from my rifle he got away.

We made a cairn of stones on the south-east side of the cape near the foot of the talus, and placed in it a spirit tin containing a "Jack" and the following record :

"THE JACKSON-HARMSWORTH POLAR EXPEDITION,

" March 28th, 1896.

"Three members of the above expedition arrived off this cape on March 25th, 1896, but meeting with a vast extent of open water reaching south-west, west, north-west and north, they pushed on east for the land and camped here on March the 27th, when Armitage and Jackson ascended the cape and at the points of the compass mentioned could see no ice, as far as the eye could reach, and only two islands beyond the immediate land to the northward.

"We are leaving to-day to explore to the west of Brady Island before returning to Cape Flora, seeing that a further advance north this season is impossible.

"A. B. ARMITAGE.

"K. BLOMKVIST.

"FREDERICK G. JACKSON,

"Commanding the Expedition.

"The open water runs into the land at this cape cutting off all advance north."

Having made the cairn and deposited the record, about eight yards from the beach and one hundred and fifty yards from the ice slope coming down off the cape, we packed up and proceeded diagonally across Markham Sound. Course S. 33° E. (true) over deep, soft snow, which made it heavy going.

About a mile and a half south-east of Cape Richthofen we came upon an open crack with water standing in it about forty inches wide. This we got over without much difficulty. The ice was two feet four inches thick with eighteen inches of snow covering it.

At 3 P.M. we called a halt, having travelled six miles. It has been snowing all day with a dense mist. Having made tea and had some cheese and biscuits for lunch, we proceeded another mile on the same course, when the mist lifted a little, showing the land to the south of us apparently split up by a narrow fjord or fjords. The country here rather suggests the west coast of Norway in the winter. Most of the rocky bluffs are ice-domed and of the prevailing basalt. One hill on the eastern side of the fjord appears to rise to a height of 1500 to 2000 feet, the highest I have yet seen in Franz Josef Land. On seeing this I decided to make for the northern end of the fjord on the east side of an island named by me David Wilton Island, composed of a huge, flat-topped, basaltic rock, which appears from our position to be rectangular, instead of proceeding down to the sound further to the eastward. I had seen a short way down this sound from my position on the summit of the cape yesterday and I have every reason to believe that I can push east out of it after exploring the fjord we are now making for, as

we must hit the eastern end of Allen Young Sound by pushing south.

We now struck out S. 14° E. (true) and travelled in this direction five miles, stopping at 7 P.M.

In the afternoon Armitage used his snow-shoes which enabled him to get along better. He had numerous spills, as he is unused to them, but got on better towards evening. The chief drawback to his capsize was that whenever he went head-over-tip the dogs at once stopped, presumably either to laugh at or to admire his performance, and this led to consequent delays, as the four sledges had to be hauled up each time to give them a fresh start, but we got some fun out of it. I could take no angles to-day owing to the mist and snow and I intend to camp until it clears a bit to enable me to do the necessary mapping. Better to take longer and do it correctly than to push on and accomplish nothing of value to anyone.

Courses :—S. 33° E. (true) 7 miles. S. 14° E. (true) 5 miles. Total 12 geographical miles.

I only count miles made good in definite courses, from point to point, as distance allowing for winding about to avoid obstacles cannot be accurately reckoned, and an estimate of distance covered allowing for wanderings can serve no good purpose, and has only been adopted by some travellers to increase the distance covered on paper, which in most cases is very much over estimated.

The thermometer has risen as high as $+13^{\circ}$ to-day. This spring has exhibited the most extraordinary mild weather on record for these latitudes I should say.

March 29th, Sunday.—The thermometer is up at $+15^{\circ}$ and a gale (force 7) is blowing from the west with thick driving snow and dense mist. As I wish to take

bearings and sketches, and, if possible photos, before proceeding into the fjords to the south I have decided to camp for it to clear a little. The rise in temperature is playing havoc with our furs which are getting very wet inside the tent and are beginning to rot.

I took the opportunity of our wait to have a good mending of our gear, and we spent the time in smoking and in reading one or two copies of old newspapers which we happen to have with us—even the advertisements are not neglected. They are often more amusing than news nearly two years old. The weather became worse with very thickly falling snow as the day went on, and we could not see more than thirty yards from the tent. Our camp is extremely uncomfortable, and the weariness of waiting for the weather to clear is almost unbearable. Inaction, of which one has such a large share in the Arctic, is very trying. We are very tired of these “bad weather camps.”

March 30th, Monday.—Still blowing hard from the west with dense mist and thickly driving and falling snow. The ribs on either side of the entrance to the tent have given way and the snow drives into it in a most persistent manner, making everything a bit uncomfortable as a consequence. I feel a little uneasy lest the westerly gale should cause sufficient swell in the sea to the west of us to break up the ice upon which we are camped, but I think it is sufficiently strong to withstand it, and the wind may bring in the pack from the northwest against the floe edge, which will protect it. We have spent the day in much the same manner as yesterday. The thermometer has kept at $+15^{\circ}$ very regularly. I am inclined to think that our aneroid has gone wrong, since it stands at 30.80 and has only fallen a very little in spite of this beastly weather. They are

very unreliable things, and I have a great dislike for them, but it is impossible to carry a mercurial barometer sledging.

March 31st, Tuesday.—Early this morning there was some improvement in the weather, and I had intended after breakfast to set to work to dig the sledges out of the drift in which they are buried, but it soon came on as bad as ever, blowing from the west with dense mist and thickly driving and falling snow.

We remained camped all day as I do not wish to proceed further south until I can get a view of the surrounding country to continue my mapping. I refilled my hand-camera and placed fresh films in the dark slides of the half-plate camera. We spent the day in reading and smoking, and occasionally making remarks uncomplimentary to the present weather.

At 9 P.M. as I was cooking our dinner I saw a bear coming towards our camp from the east at a fast trot. I hastily got out my Lee-Metford rifle and hand-camera to take a snap at him as he came up. At twenty yards off I gave him an exposure of one-fifth of a second, but unfortunately found afterwards that I had stop thirty-two on instead of stop eight which with the dim light I fear will be insufficient.

He came on without a moment's hesitation and with the utmost boldness. Why should he fear? He had never come in contact with man before probably. When he was about fifteen yards off the tent I laid down my camera and shot him through the neck. He reared up on to his hind legs probably owing to the shock caused by my bullet, and Armitage fired at him in that position but missed him, and he then made a rush towards a group of four dogs which were tied up to an ice-axe driven into the snow, but a second shot from Armitage in the

shoulder induced him to change his plans and rolled him over. He however, got up again like the cat with nine lives, and made off at a great pace; but another shot from me behind the shoulder at about sixty yards knocked him out entirely. He was a fine he-bear, and I noticed that there were indications about him that it is the rutting season, which may account for his boldness and absence of all caution. He was in rather poor condition and had only some paper, picked up near our camp, and some blood in his stomach. We gave the dogs a huge feed and I intend to take a quantity of meat on with us and to make a cache of sixty pounds of tinned beef on David Wilton Island to the south of us.

There is every appearance this evening of open water to the E.N.E. and S.S.E. from here, a heavy laden watery-looking sky overhangs those points, but water skies are often deceptive. I, however, feel sure there is open water in Austria Sound to the north of McClintock Island.

April 1st, Wednesday.—The day opened bright and clear, and after having breakfast I took several negatives and a round of bearings, and made sketches from the top of a flat berg (photographed) near our camp. After digging out the sledges, some of which had entirely disappeared from sight in the drift, we packed up, and started for the eastern side of the rocky table-topped David Wilton Island about five miles off, and Cape Ballin Temple a little to the east of it upon Bromwich Island, being very glad to leave our late uncomfortable quarters. This we reached, after about two hours' travelling over fine level ice (S. 7° W. true), and stopped for lunch near its south-east side. Here I made a cache of the sixty pounds of tinned mutton, which will be useful next spring perhaps, covering the tins carefully with large stones.

The cache is towards the south-east extreme of the island, immediately below some low rocks which jut out of the talus of the cliffs and seventy yards from the floe edge.

We placed some large stones upon a boulder above the cache to attract attention. We then started off

IN VESSEY HAMILTON CHANNEL

S. 60° E. for three-quarters of a mile to get into the centre of Vessey Hamilton Channel, named by me after the Arctic explorer, Admiral Sir Vessey Hamilton, to enable us to see both sides of it, as it was now misty. At 7.30 P.M. we camped on the lee side of some low, flat bergs west of the conical rock.

An ivory gull put in an appearance at the skeleton of the bear just before we left camp, but did not stay more than half a minute.

Courses :—S. 7° W. 5 miles ; S. 60° E. $\frac{3}{4}$ miles ; S. 12° E. $3\frac{1}{2}$ miles. Total $9\frac{1}{4}$ miles.

We were pushing down the fjord, the dog team

being ahead, when flames surprised our eyes, the scent of burning reached our noses. What could it be amid these icy wastes. The mystery was soon explained—we had a conflagration upon the second dog sledge. Blomkvist, in knocking the ashes out of his pipe, somehow or other managed to set fire to the ration bag and a gun-case with the Government rifle inside, which, fortunately, did not proceed to distribute bullets around, burning large holes in each. The fire spread so quickly that it burnt the horizontal bar of the sledge. It was but a momentary excitement; but it came as a blessing, for it gave us food for conversation for hours afterwards and jokes at Blomkvist's expense.

April 2nd, Thursday.—Started in a dense mist with overcast sky, and soon after leaving camp it began to snow. We pushed on down the narrow fjord, finding great difficulty in seeing a way, as owing to the fog the land seemed to surround us, and no outlet was visible. I had much trouble in keeping the pony's snow-shoes on, as the canvas has got very hard and stiff and chafes her feet just above the hoofs. I must improve upon them for next year.

We stopped for lunch under the lee of a berg, having gone four miles. We always dislike stopping for lunch, as we get very cold in the process. Imagine sitting on a sledge, six inches from the ice, in thickly falling and driving snow, with a high and bitter wind blowing, trying to cook one's food. Every now and then we would get up and stamp about to restore the circulation to freezing feet, or to swing one's arms across our chests to induce warmth to our bodies and frost-bitten fingers. We did not linger longer than was necessary over it, and were always glad to move on again and return to our tugging and hauling at the sledges, tired though we might

be. It was still snowing heavily, with a fresh southerly breeze, and was very misty and overcast. The land appeared to shut us in ahead, but the light was such that we could see nothing a quarter of a mile away to be sure of it. We pushed on, and presently an exit opened out in front of us. After going about two miles we were abreast of a bold, high, basaltic rocky headland, which I named Cape Taylor after General Sir Richard Taylor. We passed a low berg evidently aground and surrounded by water and thin ice. In the water a number of dovekies were swimming. Shortly afterwards we passed two more bergs also doubtless aground, and surrounded by water in which were dovekies. I also noticed a walrus hole, by the side of which a walrus had recently been lying to judge by the fresh dirt on the edge of it. The floe now became very thin and wet, nothing but recent bay-ice in fact. Considering the unsafe appearance of the water beneath the snow, the dense mist which prevented our seeing ahead, and the very evident indications of open water being at hand, I changed our course from E.S.E. towards Brady Island and struck out for Cape Taylor to the westward. This we reached after great trouble and hard work, for the floe as we advanced became very rotten, and we waded about in slush up to our knees, being obliged to take our snow-shoes and ski off to help the dogs. They were frightened out of their lives, and instead of attempting to pull, they all clambered upon the top of the leading sledge and howled dejectedly, evidently thinking they would be drowned. They could only be got off the sledge with great trouble. After much bother I got "Brownie," who behaved very well, and my sledges to the shore, and leaving her there, returned to help Armitage and

Blomkvist with the dogs and their four sledges, which we had to haul singly to shore, as they dragged terribly heavy in the boggy slush, and the dogs were too much scared to do any steady pulling.

We eventually camped about 11 P.M. on the shore at the south-east point of the headland, and were very glad to be on *terra firma*. I noticed a small glacier coming over the face of one of the basaltic rocks on the western side of Vesey Hamilton Channel, running down the talus to within three hundred feet of the bottom, and there ending in an abrupt perpendicular face about twenty feet high. A number of small bergs had broken off the glacier face and had rolled down the talus and were lying at the foot of it.

I saw a "mollymoke" near our camp of this morning. All of the rocks in this neighbourhood are similar in character to Cape Flora.

Courses :—S. 5° W. seven miles ; N. 80° W. one mile. Total eight miles.

April 3rd, Friday.—Turning out at 5 A.M., the mist partly lifted to the eastwards, showing open water reaching entirely across the sound, and quite cutting off any advance in that direction which I had intended to take. The temperature has risen to $+22^{\circ}$, and it is snowing, overcast and very misty. After breakfast I wrote the following record, which I placed in an empty spirit tin, together with a Jack, and buried it in a cairn made of stones upon the top of a large boulder near the south-east point of the cape and about thirty yards from the shore. The talus at this point runs nearly to the water's edge, and there is very little of the usual plateau or raised beach. More to the westward the rocks recede further back.

"THE JACKSON-HARMSWORTH POLAR EXPEDITION,

"April 3rd, 1896.

"Three members of the above Expedition reached this spot at 9 P.M. of April 2nd, 1896, being prevented from proceeding further in a southerly direction by rotten ice and open water in the straits to the eastward. We intend to endeavour to cross the sound to the westward, or finding the ice too rotten, to retrace our steps into Markham Sound and to return to Cape Flora by our route of last spring.

"A. B. ARMITAGE.

"K. BLOMKVIST.

"FREDERICK G. JACKSON,

"Commanding the Expedition."

We started along the slope of the shore skirting the cape, carefully keeping off the floe until we came to the face of a very rough glacier, having a very crevassed, hummocky, and uneven surface, and near the face of it, hardly detached from the glacier, were a number of more or less broken-up bergs, which evidently had not sufficient water to launch them and enable them to get away, but had been jostled along in front of the ice behind. Some were quite black from having been turned over and over in the mud. At this point we were obliged again to take to the floe to proceed further, and to our great relief we found it here fairly sound, although deep with soft snow. It has been snowing all day (like that of an English snowstorm in heavy, large flakes), and the thermometer at noon rose to $+27^{\circ}$, with dense mist, overcast sky, and a south-east wind blowing. We stopped for lunch off a berg near the western extremity of the glacier, where I photographed our caravan. We had

come three miles (direct) N. 70° W. We then pushed on, and rounded the long tongue of land in front of the bold rock (700 feet high) at the south-western extreme of Fridtjof Nansen* island and camped on the snow slope on the western side.

Course :—N. 70° W. (true) seven miles. Total seven miles.

The incline of the rough glacier is small, not more than from six to eight degrees, and the country behind is about nine hundred or a thousand feet high. The two high headlands to the east (800 ft. high) and one 1300 ft. high send down the ice from their caps and form the glacier. I think it would have been nearly impossible to have taken a sledge across it, owing to its broken up character. One berg lying just off the face of the glacier had evidently been rolled over and over in front of the advancing ice, and was as black as an ink-bottle from the crown to the base.

I am doubtful if this plateau is a raised beach as the stones on the surface showing above the snow are pointed and angular, and exhibit no signs of water wear. I could find no driftwood, but the spot is not a likely one for it. The height is about eighty feet. It may, however, be a raised beach, but covered with angular *débris* from the rocks above. Snow rendered an examination difficult.

April 4th, Saturday.—As soon as I turned out, the weather being fairly clear except to the eastwards towards the rotten floes and the open water, I ascended to the top of the plateau and took bearings and sketches. We then packed up and proceeded across the Robert Peel Sound towards the round of the glacier to the north of Guy's Head, which I named after Guy's Hospital, out of

* Afterwards named by me after Dr. Nansen.

compliment to our doctor who studied there, where we took an observation for latitude and longitude last spring. In common with all the other ice we have met with, the sound has cleared out since last spring, and now the ice in it is quite level instead of very hummocky as then. We camped for lunch close to the old columnar rock, Guy's Head, near the site of our camp of May 7 last spring. I again took bearings. The weather has been very misty and overcast, occasionally snowing, and the very high temperatures make the snow bad going. After lunch we kept on the same course, as I wish to accurately define the south-western side of the island—it was misty when we passed up about three weeks ago. I also wish to map exactly and to complete the land extending northwards from Leigh Smith's Peterhead. We stopped at 6.50 P.M. having proceeded eleven miles from the morning camp. I stopped on two occasions after lunch to take bearings and sketches, when the mist lifted a little, and also did so on stopping to camp for the night.

A flock of looms were seen flying westward this afternoon. The snow on the floe has been very deep and soft. There has been a heavy snowfall here since we passed across it in the middle of March, and apparently very little wind. There is evidently open water in De Bruyne Sound near the first dépôt we made on Hooker Island last March year. We could see a water sky at the south-east end of Smithson Channel.*

Course :—N. $69\frac{1}{2}^{\circ}$ W. (true). Total eleven miles.

April 5th, Sunday.—We woke up this morning to find that we were camped within half a mile of open water. The northern water has apparently extended south

* Named by me after Mr. G. E. T. Smithson, Secretary of the Tyneside Geographical Society.

since we passed north in March, or else owing to the thick weather we went close to it without seeing it. I am now going to march a bit south of west to avoid it. This is a country for open water, it meets one at every step. A dense mist came up just before we left camp which prevented our seeing more than fifty yards around. We stopped for some food after going eight miles a little south of west, when the land to the east of us showed out through the mist and I took bearings.

Then proceeded S.S.W. (true) four miles and camped, and I took bearings and sketched in the coast line to the east. No land can yet be seen to the west of us or anywhere in that direction.

Courses :—W. (true) eight miles. S. 83° W. (true) four miles. Total twelve miles (geographical).

April 6th, Monday.—On turning out only land to the eastward and the land to the north-west could be seen, and also a small island (probably Eaton) bearing 197° (magnetic). Later on the mist lifted showing an apparently entirely glaciated land (no rocks visible) to the westward. We have now a better temperature, the thermometer being $+5^{\circ}$ and towards night 2° below zero. I took bearings and made sketches.

April 6th (3 P.M.).—After leaving our morning camp we proceeded two miles N. 82° W. (true), and I took one series of bearings, and then S. 85° W., three and a half miles till lunch, when we stopped and took bearings, astronomical double altitude observations for latitude, longitude and variation, and then proceeded S. 85° W., till we camped for the night.

We passed through very deep snow, and a great part of the distance over very hummocky ice; I however, have seen no old floes since we left Cape Flora, only ragged detached pieces of ice frozen into last winter's ice.

This shows that there was navigable water at the end of last summer throughout the whole of our course.

I shall certainly take the *Windward* north, when she comes up this summer. Sledging over a navigable sea is absurd. The mist lifted about 10 A.M. this morning, showing the land clearly at all points except to the westward and south-west, and lifted in these directions at intervals showing the land indistinctly. The sky cleared and the sun shone brightly till about 4 P.M., when it began to cloud over from the southward. I took angles at three positions, and at 3 P.M. (2 P.M. would have been a better time) Armitage and I took astronomical observations for double altitude with sextant and ice horizon for the latitude, longitude, and variation. Two hours after noon is supposed to be the limit in these latitudes for observations by double altitudes. The sun is putting a glaze on the snow, but is weakening the crust which lets us through with a jerk at every step. I took three photographic negatives of our lunch and observation camp.

On stopping at 9.15 P.M. to camp, a moderate southerly wind was blowing, and the sky was fast clouding over with dense mist. The wind rapidly increased to a moderate gale from south-east at 10 P.M. with a quickly falling barometer, and the weather generally looks very ugly again.

Courses :—N. 82° W. 2 miles. S. 85° W. $8\frac{1}{2}$ miles. Total $10\frac{1}{2}$ miles (geographical).

April 7th, Tuesday.—This morning it is blowing a strong gale from E.S.E. with fiercely driving and falling snow, and the atmosphere is so dense that one cannot see twenty yards in any direction ; consequently we have to remain camped, few things being so irksome and generally disagreeable. Snow drives in all over the interior of the tent, our furs and gear generally are in a very moist state,

and the condition of things anything but pleasant. We can't stand up to stretch ourselves, and even when lying down the three of us do not have much spare room. We spent the day smoking and reading a two-year-old newspaper, even the advertisements receive close attention. We almost know some of them by heart. The gale continued throughout the day with unabated violence, although once or twice it lulled for a few minutes, which gave rise to hopes that we were getting towards the tail-end of it. The atmosphere is as thick as a hedge with falling and driving snow and dense mist. I hope the violence of the wind will not break the ice up, and send us adrift.

April 8th, Wednesday.—The gale continued throughout the night, but lulled about noon to a strong wind, with thick mist and snow, and the weather looks very promising of further favours to come. Our sledges are buried out of sight, and deep drifts have formed around and half buried the tent. I removed the exposed negatives from my hand and half-plate cameras, numbered the films, and filled the hand-cameras and dark-slides with fresh ones. Armitage worked out the observations taken for position on the 6th, and we all growled at the weather!

The gale has woke up as fiercely as ever, and dense mist with driving and falling snow is the order of the day.

I had an attack of migraine during the night and turned out with a bad headache in the morning. Blomkvist complains of pains in his back—doubtless from sitting so long in the cramped position in the tent. We laugh at our aches and pains, but wish we had here some of the armchair-geographers from home. Yes, we wish we had them here, to enable them to enjoy themselves, and to give them the opportunity of gaining some expe-

rience of the difference between real and imaginary exploration in unknown and inhospitable regions.

April 9th, Thursday.—There is some improvement in the weather this morning, but it looks anything but promising. We are very anxious to move on, for a more uncomfortable camp it is difficult to imagine. Everything inside the tent is reeking with wet, and our furs are rotting fast and giving forth most unpleasant odours owing to the prevailing high temperature, as there are only a few degrees of frost, and all our clothes are damp and feel sticky. Armitage is complaining of lumbago and Blomkvist of cramp. I'm sure I don't wonder at it. The snow is cut into ridges but is little hardened. The wind alternately freshens up to a moderate gale and then slackens to a fresh wind. Snow is falling and driving into the tent. We set to work to dig out the sledges so as to be ready to start; they were buried three feet down in some cases.

Some little improvement occurring at 6.20 P.M. having had more than enough of our camp, we set out in a strong wind and driving snow and after proceeding two and a half miles S. 82° W. (true) we got amongst very hummocky, broken up ice with numerous traps; the pitfalls were so many and frequent that I feared for the pony's legs. To get clear of this stuff I altered the course to south (true) and after going another three and a half miles we camped at midnight.

The snow has been exceedingly deep and soft, the sledges drag very heavily, and the temperature of $+28^{\circ}$ makes it of the character and consistence of moist sugar. At noon to-day the snow was melting on all such articles as absorb heat. "Carlo" and "Bear" have been entirely on the sick list during the march to-day. The former I tied upon a sledge and covered him up as he

cannot even walk. He has done very well, poor old chap, and is very game. "Bear" is not quite so bad, but walks by the side of the sledges. I took bearings of Eaton Island and the Rubini Rock on arriving at camp to fix our position. No other land can be seen.

Courses :—S. 82° W., $2\frac{1}{2}$ miles. S. (true), $3\frac{1}{2}$ miles. Total, 6 miles.

April 10th, Friday.—Blowing a moderate gale from S.S.E. with falling and driving snow, becoming south-east later on, and the weather looks as nasty as ever.

We, however, packed up and started, carrying poor "Carlo" on the sledge as he seems no better, and leading "Bear," who looks most dejected.

We struck S. 31° W. through hummocky ice towards indistinct land seen early this morning. I am very anxious to accurately define the land running north from Leigh Smith's, Peterhead, but the badness of the weather has prevented our getting a fair sight of it once. After going on this course for four miles, wandering about very much owing to the rough ice, we again came upon the broken-up, trappy ice, and to avoid it I struck about S. 20° W. and went a mile and a half. The falling snow had so increased in density together with the thick mist and the already fallen snow driven by the wind, that it became very difficult to see the snow beneath one's feet, and Blomkvist and the leading dog-sledges toppled over the edge of a sharp drop several feet in depth, which had been cut by the wind round the edge of a large hummock before he saw it, and they arrived at the bottom in a very mixed-up condition, sledges, dogs and man in a confused heap, from which proceeded howls and unparliamentary English. This and similar little accidents induced me to give the

word to camp at 7 P.M. as I feared that we should get a sledge or two smashed in this worse than semi-darkness. Clothes and pockets are full of wet clinging snow and everything is moist. (Temperature $+ 28^{\circ}$, falling to $+ 20^{\circ}$). Poor "Carlo" died during the afternoon. Doubtless as he "gave up his life in the cause of science" he is more than satisfied, and science will feel very grateful to him. On examination his lungs showed traces of inflammation. Probably this delightful weather brought it on.

Courses :—S. 31° W., 4 miles. S. 20° W., $1\frac{1}{2}$ miles. Total, $5\frac{1}{2}$ miles.

April 11th, Saturday.—Snow falling and driving this morning with moderate south-east, west, and west-south-west winds. It was snowing heavily when moving camp, with thick mist, but cleared up a bit as the day went on. We proceeded S. (true) for four miles and then stopped for food. The mist was very dense at first, and the snow throughout very deep and soft; but about 3 P.M. it cleared somewhat, giving me indistinct outlines of the land to the westward, and was fairly clear to the east. Peterhead is rather a mystery to us. No sign of a headland is to be seen or even land at all in the position assigned to it on Mr. Leigh Smith's map, and it must be further west. He evidently came up here in very misty weather, or he must have seen the land east of here which is very distinct and bold, especially the Rubine Rock. All the land to the west is low and undulating near the coast, and doubtless the glacier projects some distance beyond the land. However, the conditions of the last week have been very bad for seeing coast lines distinctly.

The lights varying very much have rendered any

attempt at judging distances of land very difficult ; the same land looking five miles distant at one moment, and five minutes later looking twenty.

On viewing Camp Point on the mist lifting for a few moments, bearing S. 7° W. we made for it and later on kept three points further west to clear it. We camped at 8 P.M. and then apparently Camp Point bore from us, about seven miles distant, S. 8° W.

Courses :—S., $5\frac{1}{2}$ miles. S. 7° W., $2\frac{1}{2}$ miles. S. 10° W., 2 miles. Total 10 miles.

April 12th, Sunday.—Very misty, snowing and a moderate gale blowing from south-east. Armitage is complaining of rheumatic pains in the back, and Blomkvist had toothache during the night ; not surprising after the time they have had. In spite of the vile weather I determined to push on instead of camping. Started off S. 22° W., and went four miles and then stopped for food. It was snowing very heavily and driving before the gale, which was now from the east, and during the hour and a quarter we halted, the sledges became nearly drifted under. We then went on for another mile and a half on the same course when the mist and snow cleared slightly, showing Camp Point about a mile and a half to the east of us. We then struck south-west for the west point of Cape Flora. The weather continued bad, and the gale and snow continued. To cut short the discomfort of such weather I determined to make a forced march to the hut, although we were fifteen geographical miles away from the settlement. At 10 P.M. we stopped for three hours, put up the tent, and gave all the animals a feed and rest, and had some oatmeal porridge ourselves. The wind had now dropped to a moderate breeze and had changed to north-east and gradually increased in force to a fresh gale. We reached our hut at 4 P.M. on the 13th

having travelled twenty-one miles. We had used snow shoes continually for the last fortnight owing to the deep snow, and the pony has also been similarly equipped with some we had made for her. She certainly could not have got along at all without them. Round the west point of Cape Flora we found the ice swept clean of snow by the gale then blowing. We hauled the sledges up the flagstaff slope on to the pond near the hut. Our shouting to the dogs aroused the sleepers within, and they turned out and gave us a hand, which we were glad of, being cold, tired and hungry. All were well and everything had progressed satisfactorily in our absence.

Courses :—S. 22° W., $5\frac{1}{2}$ miles. S. 45° W., $12\frac{1}{2}$ miles. E., 3 miles. Total 21 miles.

CHAPTER XXIV

AT CAPE FLORA

April 13th, 1896, Monday.—We got back to our little settlement at 4 A.M. this morning, having made a forced march from De Bruyne Sound, about six to seven geographical miles on the northern side of Camp Point; travelling all day and night on snow shoes with a gale of wind blowing and dense snow falling and driving. Altogether it was a most unpleasant march. Our journey has been a most disappointing one so far as getting north is concerned, especially as we all three felt quite certain, after we had got along so well during the first week, and the animals were improving in their going, of beating the record of the "Farthest North,"* if we only had sound ice to travel upon. We have, however, been able to do some useful geographical work, having determined the extent of North-west Franz Josef Land, mapped in the western coast of the British Channel, and traced new coast-lines. We have corrected and verified my map made last year, and have made a depôt in a position which will be useful next spring, when I mean to try and push north *viâ* Rawlinson Sound, as I am convinced that the route I have now attempted two years is impracticable on account of open water in the British Channel and the Queen Victoria Sea.

From what I have seen of the ice up north this year I feel more than ever that we were lucky to be

* Nansen chose this as the title of his book nearly two years later.



able to get off it in time last year. I quite believe that open water does not occur through any chance circumstances, but that conditions (strong currents and gales) which cause it are fairly constant year by year, and that where it is met with one year one may reasonably expect to find it the next ; or, if not actually open water, boggy floes which are closely approximate to it, and which a gale of wind from a certain direction will quickly convert into open water. It is a great pity that the route I have tried is a failure, as it led directly north, whereas the one by Rawlinson Sound trends a long way eastward. Rawlinson Sound is, however, so far as I can see at present, the only way north now from Franz Josef Land.* This part of the world is a difficult one to travel in on account of the liability of being cut off by open water, and its climate, bad even for the Arctic. Who could have foretold this expanse of water would confront us, or that Franz Josef Land was not the land-mass of possibly continental dimensions depicted on the map and so believed to be by Arctic authorities. We have at all events proved that it is not a continent, and that on the western side at all events it goes nowhere near the Pole. This year especially, water surrounded us on all sides, and stopped our advance in three different directions. A boat or canoe ought to be carried, but it hinders one's advance, so we must risk it without. I believe that the ice Payer saw surrounding the polynia off Cape Fligley was more or less broken up disconnected ice, and ice over which sledges could not travel. On reaching the hut the doctor and the others turned out, lighted a fire, got us some food, and the three of us then turned in, being very glad to get out of

* Since writing this I learn from Nansen that Rawlinson Sound does not exist at all.

our damp clothes, and feel warmer and cleaner than we had done for weeks. Armitage and I had a wash every morning when sledging, and I always stripped to the waist when so engaged, for I prefer to feel a bit chilly for a few moments and know I am clean afterwards, even if it only be a wash in a teacupful of water. I would rather go without my dinner than without my scrub.

We were weighed during the course of the day by the doctor :

	On March 13th.		April 13th.
Armitage	185 lbs. = 13 st. 3 lbs. ...		171 lbs. = 12 st. 3 lbs.
Blomkvist. . . .	192 lbs. = 13 st. 10 lbs. ...		187 lbs. = 13 st. 5 lbs.
F. G. Jackson . .	189 lbs. = 13 st. 7 lbs. ...		181½ lbs. = 12 st. 13½ lbs.

Armitage lost a stone, Blomkvist five pounds, and I seven and a half pounds. Both Armitage and Blomkvist still complain of rheumatic pains.

It has been blowing from a fresh to a strong gale with thickly driving snow all day, and has opened up a long lane of water off Cape Fora. The sea off here, with the exception of occasional open pools, had been closed for many weeks, and this is the first northerly wind of any force and duration since February 19th, which is a very unusual state of things. Such a spring as this in this latitude, I should say, is unprecedented. I learnt on getting back that "Tommy Rot" had been killed by a bear a few days previously. He had received one bite across the back. The bear had abstained from dining upon him, apparently not relishing dog-meat, although he carried an empty stomach, and had gone off on to the floe, where he was shortly afterwards shot by the doctor. He had apparently caught the dog on the stable roof, which in consequence of drifted snow is nearly level with the surrounding snow-covered

ground. He had killed the dog, as far as could be seen, from sheer mischief or savergy.

April 14th, Thursday.—I took negatives of the sledges, unloaded them and stowed the gear away in No. 1 canvas hut. The others were engaged in various jobs. The doctor went on getting the blubber off one of the bear skins. Armitage and I took a solar observation for time after lunch. I had the dogs fastened to the square formed of spars outside the dog-house, as it is more healthy for them there now than in the kennel. They did very well on their pound of meat per day each while sledging.

April 15th, Wednesday.—Snowing, overcast and misty all day, with winds from force 2 to 4 from W.N.W. and easterly till 5 P.M., when it went into the north-east and very rapidly woke up into a strong to full gale, with furious continuous gusts, up to force 11 with intensely thick driving snow. Why it can now blow harm from a northerly direction with plenty of open water up there, whereas for two months it has been unable to accomplish it, is strange. After meeting with such an extent of open water up north we naturally attributed the warm weather and the prevalence of southerly winds to its presence; but here is a hard gale from the north-east with all the previous conditions unchanged. The more one sees of this part of the world less sure one is about anything.

The temperature at 8 P.M. had fallen to -5.5° below zero from $+11^{\circ}$ at noon. This fall of temperature I afterwards learnt from Nansen froze up a portion of the water which stopped us, and allowed him and Johansen to round Capes McClintock and Richthofen.

I occupied myself in drying things brought back from the sledge journey and in washing some clothes.

The doctor went on with the bearskins in No. 2 ; Armitage worked out the observations taken for "time" yesterday, and in again working out the observations by double altitudes for position and variation taken on the journey. I went on developing my quarter-plate negatives taken then. All have turned out well, and I have managed to hit off the exposure pretty accurately. Very important ones, namely, the face of a glacier close to Cape Richthofen, which I ascended to view the open water and to take bearings, and show perpendicular striations of dirt, have come out well.

April 16, Thursday.—Armitage again worked out the observations taken on April 6th for position, by reduction to the meridian, to check it against the same worked out by double altitudes.

Double altitude (Sumner's method) : Latitude, $80^{\circ} 30' 15.76''$ N. ; longitude, $1^{\circ} 27' 06.28''$ E. of Cape Flora.

By reduction to the meridian : Latitude, $80^{\circ} 29' 56.67''$ N. ; longitude, $1^{\circ} 27' 41.55''$ E. of Cape Flora.

Variation, $15^{\circ} 45' 11''$ E.

Mean : Latitude, $80^{\circ} 30' 06.21''$ N. ; longitude, $1^{\circ} 27' 23.91''$ E. of Cape Flora.

Cape Flora (our hut) being considered as $0^{\circ} 00' 00''$.

April 18th, Saturday.—The hut has got into a fearfully dirty condition, and the felt and cocoanut-matting from smoke and dust from the stove, and filth brought in upon boots, is coated with dirt. Being a fine day Fisher and I set to work to clean everything out. We pulled up the well-worn felt and matting and beat them outside and thoroughly cleansed the floor, getting into every nook and corner with soap and water and plenty of elbow grease. Armitage, helped by Child took a lunar for longitude about noon. In the afternoon I turned to and cleaned my cabin, which had got much smoke and dust begrimed. It is quite

impossible to keep things clean in the hut, what with damp, smoke and dust, but the "spring cleaning" has made some improvement.

April 20th, Monday. — I went through the dead reckoning of the spring sledging of 1895, with Armitage, checking that of this spring and bearings I took then. I find that there is $18\frac{1}{2}^{\circ}$ of local deviation on the bearings I took on the summit of Cape Richthofen, pulling the needle to the westward. The rocks are all basaltic apparently, and doubtless contain magnetic oxide of iron. I was fortunately able to check these bearings with known positions fixed by our astronomical observations, and also owing to the wonderful clearness of the atmosphere on the 27th of March, and probably also refraction, was able to see and get a bearing of Mabel and Bell Islands, which are also accurately fixed.

Child repaired the stovepipe which has again burnt through. The doctor went on with the bearskins.

I went up the talus about 6 P.M. There is not much open water to be seen off Cape Flora now, but all the ice is in a very loose condition with lanes frozen over with very young bay-ice.

The sun is causing the snow to evaporate rapidly. A few looms are now upon the upper tiers of rocks, but are quite out of gunshot, as none are yet upon the lower ones. This is a remarkable change in the weather after what we have had for the two last months, and there appears to be no reason for it, as the conditions of open water, north and here, are still the same so far as we know, unless a great part of the open water to the north of us has been filled up with drift-ice quite recently or frozen over. The recent northerly gale may have brought ice down and filled up what was then open water. The fall in temperature looks rather like it.

April 22nd, Wednesday.—Hearing about 6.30 P.M. that an ivory gull with dark markings, similar to the young ones I shot last autumn, was flying about near No. 2 hut, I took a shot-gun and succeeded in bagging it for a specimen. I should have expected that the young of last season would by now have put on their adult plumage, but such is not the case. The young “burgies” appear to change theirs before putting in an appearance in the following spring, or at all events nearly the whole of the brown has disappeared, but in the case of this gull it was still in its first season’s plumage.

April 24th, Friday.—Anything I am not absolutely sure of I am omitting entirely from the map. Better have nothing than have it wrong. It is an extremely difficult country to survey owing to the constant mists, refraction, the abominable climate generally, and also to the fact that some of the basaltic rocks, of which the whole of this country, so far as we have seen, consists, are magnetic, and cause local deviation of the compass. For instance on Cape Richthofen the needle was affected to the extent of $18\frac{1}{2}^{\circ}$ deviation to the left. There is nothing visible in these basaltic rocks to indicate whether they have the magnetic oxide of iron in them or not, and as a rule it is only by checking the bearings upon a position fixed by astronomical observation that the error can be discovered, and often this is impossible. One has to avoid the proximity of rocks as much as possible in taking angles.

April 27th, Monday.—At 12.45 A.M. just as I was turning into my blankets “Nimrod” began to yell bear!!! I got my hand camera and .303 rifle and went outside the house to try and get a few snap shots at him as he approached. I was successful in doing this and got twelve negatives; a few of these are fairly good, but

some of them are rather fuzzy, as he proved a bad sitter and would not remain still long enough. I took the last three after he had approached within ten to fifteen yards of me, and as he then showed a decided intention of "going for" "Nimrod," who was chained up close by me I thought it was time to stop him. I gave him a bullet through his chest which passed through his lungs. This however did not knock him out, but he wheeled round and Armitage, who was waiting in the entrance to the hut out of sight, gave him one in the rump, which broke his near hind leg; I followed up with one in the shoulder, which broke it and smashed his backbone, giving him his quietus. I then photographed him again, and Blomkvist, who had turned out, Armitage, and I, managed to sledge him into No. 2 canvas hut, where we covered him up with furs to keep him from freezing. Child very good naturedly turned out to develop the negatives I had just taken, as we were all anxious to see how they looked—some are very fair, but I hope to get better, which I shall do with a brighter light. After breakfast the doctor and Armitage skinned the bear. I refilled my camera and then photographed some ivory gulls that were feeding on some meat near No. 2 hut. After lunch I took my gun and climbed up the talus, cutting steps in the hard snow and ice, to shoot a few looms for the pot. I succeeded in killing ten looms and one dovekie, which will be a pleasant change from bear's meat. To-day is the first day that any number of birds have been noticed on the rocks, although a few have been on the higher cliffs for some nine or ten days. Dovekies and rotches appeared first of all. Kittiwakes are up there in considerable numbers. The first flock of these birds was seen yesterday. A flock of twenty snow buntings were seen to-day, being the first noticed this spring. (They

appeared on this date last year also.) We are glad to see them again, they are nice little birds, and quite the robins of the north.

The wind has been from N.N.E. and E.N.E. (force 1 to 4) a cloudless sunny sky with considerable visibility

SNOW BUNTING.
(HEN)

LITTLE AUK.

SNOW BUNTING
(COCK)

and 24° of frost; in fact one of those pleasant sunny days so rare up here.

The bear shot early this morning was a medium sized old he-bear, only 7 ft. 4½ in. from nose to tail along the belly. His teeth were much discoloured and broken. There was nothing in his stomach and he was very thin. When approaching he circled round to come up under the wind from leeward, and marched up with considerable boldness, and without any actual hesitation although as usual he wished to convey the impression to "Nimrod" and me that he had no interest whatever

in us, although at the same time keeping a sharp business eye open, looking out of the corner of his eyelids upon our movements. I got one negative which very well illustrates the nonchalant demeanour of a bear when stalking his prey. These negatives I believe are unique.

I could see no open water from the top of the talus, but only a few cracks.

April 28th, Tuesday.— Since returning from the sledging the pony has had preserved potatoes mixed with her oats, in place of the dried vegetables of which we are running short. After eating them twice, she refused to touch them again. I am now trying a little dried vegetables mixed with potatoes to tempt her. The dried vegetables make excellent horse food if used with oats or hay. I wish I had more of them; she prefers them to oats, eating the one before the other. They are however rather binding and must be used with care. "Brownie" returned from sledging looking as well after her hard work and roughing it as she did when she left.

May 3rd, Sunday.—After dinner we got the sledges ready to go to Cape Gertrude to fetch driftwood for firing. We are now using the remaining burning material left in cinders that have already been put into the stove three times! This mixed with our little remaining coal-dust makes a substitute for better fuel, but is constantly going out. There is not much more driftwood to be found; so unless the ship gets back this summer, we shall have to rely upon blubber alone.

The others amused themselves as they liked all day; they seemed to enjoy their day off on Sundays. Water was seen in a hollow of a flat rock to-day where the sun had melted the snow on the stone. It is like the first swallow of summer. From the top of the talus this

evening no open water was to be seen or even a water-sky. I have not seen such an absence of all water here for a long time.

May 6th, Wednesday.—After breakfast we again set out to Cape Gertrude to fetch driftwood, and brought back the box of geological specimens left last July, as

SLEDGING DRIFT-WOOD. CAPE FLORA IN THE DISTANCE

there was no means of carrying it then. A strong south-east wind faced us, with a temperature of 4° above zero. About noon it changed to east by north, and then back to south-east, the temperature falling to $\frac{1}{2}^{\circ}$ above zero. I fear the thermometer, keeping as low at this time of the year, with a south-easterly wind, indicates a great quantity of ice and little open water in that direction. We got back to the hut about 5.30 P.M.

The sky, cloudy at first, nearly cleared entirely later, but again clouded over in the evening.

Child let in an iron plate on the ground lintel of the

door, where the wood had been carelessly hacked away in clearing ice.

The usual four played whist in the evening. I never play because I am not devoted to cards, they bore me.

May 7th, Thursday.—To-day we fetched the last of the driftwood, having cleared Cape Gertrude. We have sledged in all about two tons. We also brought away a very odd jaw-bone of a whale-bone whale, and some ribs.

We got back to the hut about 5.30 P.M. The jaw-bone was on a low beach about ten feet above the present sea level, and about fifty yards from the sea. The ribs were about twenty feet above the present level, and three hundred yards from the water's edge.

All the driftwood collected is of very old date apparently, and some bore evidence of having been in the water a considerable time before being washed up. One piece, about five feet long by four inches broad, had the appearance of having been trimmed on one side, and a letter A was cut upon it, but it was of considerable age. It appears to be pine and birch. I am having sections made of the wood, which Fisher is undertaking, to be examined and reported upon at home.

May 13th, Wednesday.—I began a tracing of the map I have recently been plotting out.

About 1 P.M. Armitage and I took our guns and went up the talus on the east side to kill a few birds for the pot. I am keeping off the front of Cape Flora, as I am afraid of scaring the looms away by shooting there before they settle down to nesting. I shot ten looms, a dovekie, and eleven rotches.

May 16th, Saturday.—Finished my map and began inking in my surveying journal. The doctor worked at the bearskins. Fisher went on with his botanical

work. Child re-capped cartridge-cases. Armitage wrote up his astronomical observations.

After tea the doctor and I went up the east talus. Shot twelve looms and twelve rotches. I had rather a nasty slide when trying to secure a winged bird upon a steep ice-gully. My foot slipped, and I slid about eighty yards down an ice slope of 45° at a great rate; and only partly checked my pace by driving my gun into the hard icy snow, but I was going so fast that the gun was wrenched out of my hands. A low rounded boulder nearly level with the snow, over which I passed, then put the break on me a bit, and, at all events, enabled me to get a grip with my hands and stop myself. I, fortunately, was able to steer fairly clear of jagged bits of rock, and landed all serene near the bottom of the talus.

The winds have been from W. and W.N.W. (force 1 to 2), with more or less overcast sky and mist.

May 21st, Thursday.—The sun is causing the snow to melt rapidly now, and puddles of water were standing this afternoon at the foot of the talus near Mouatt's grave on the exposed soil.

I wonder if the *Windward* will get back this year. It is nearly two years since we heard news of any kind from the world!

When the ship returns I intend to take advantage of the open water, and take her north as far as possible. A lot of good work can be done with a ship here. Dredging and sounding in the fjords, botanical, geological, and other work, in addition to geographical discovery.

May 25th, Monday.—Thick, small rain was falling at 12.20 A.M. Yesterday, when walking across the fresh water pond, I noticed that the ice is rapidly getting thin, and would hardly bear my weight. There is no sign of thaw on the surface, and it is apparent that the ice

is decaying through the action of the warm water underneath. The bottom of the pond is doubtless heated by the sun's rays passing through the ice, and the

PLATEAU OF CAPE FLORA IN MAY, FROM AN ALTITUDE OF 300 FEET

water and ice above it are warmed by the radiation of heat from the bottom. The pond is not more than twenty inches deep anywhere. By temperatures taken

recently we find that the water of the thaw water pools is generally from 5° to 8° warmer than the air when the sun has been shining, even after 7 P.M., when the pools have been thrown into shade by the high cliffs of Cape Flora.

The rain continued until about 2.30 P.M. in a steady, fine drizzle, with the wind east and east-by-south; on changing to west-by-north, with light airs, it ceased. It has been overcast and misty all day.

During the morning Blomkvist and I nailed strips of painted canvas upon the roof of the hut, as the wet is again beginning to run through into the room below.

After lunch I looked out all that remain of our long sea-boots—we can no longer use fur ones—and with some trouble managed to supply all the party but myself with a new pair, as every one has worn out the ones they had last summer. Some don't fit as comfortably as they might, I fear. I must make my old ones do until the ship comes, when I expect more by her.

Fisher went on with his botanical sketches. Child reloaded cartridges for me. Armitage wrote up the astronomical observations. The doctor worked at the bearskins in No. 2.

After lunch the doctor came to tell me that he had found at the foot of the steep slope below No. 1 hut the body of the bear which I had severely wounded with the shot, that, after leaving his body, had finished poor old "Räwing" on February 1st. The rapid thaw of the last day or two had melted away the snow-drift which must have quickly formed over him then. I had sent Child with my rifle, while I was attending to "Räwing," to see if he was lying there a few minutes after I had fired at him, and he returned saying that he could find no bear. So it must have got buried very rapidly, or

sufficiently so to escape detection on a dark winter's night. The bear turns out to be a young (small) he-bear, and had

BROKEN BASALTIC COLUMNS, TWO TIERS ABOVE THE TUFFA MIXED WITH BROWN SHALE,
AT THE WESTERN END OF THE CLIFFS OF CAPE FLORA.

only managed to struggle to the edge of the steep slope, a distance of twenty yards or less from where I fired at him,

and had then rolled down the slope and become covered with snow. We dragged him into No. 2 hut to thaw as he is still frozen hard. My shot had taken him in the chest on the right side, and had passed through the body and out again on the left side, cutting through the diaphragm, liver and stomach, and letting the contents of the latter (loom skins which he had picked up near No. 1) into the thoracic as well as the abdominal cavity. The bullet then cut the bowels in several places, and escaped behind the last rib on the left side. The bowels protruded both at the entrance and at the exit wound. Part of my .450 bullet was found in the wound. The position of the wounds proved beyond doubt that the bullet, after leaving the bear's body, had hit the ground before coming in contact with "Räwing"; in fact, must have ricocheted some distance. This was the only wound found upon him.

May 27th, Wednesday. — I shot a small bird, with a flight somewhat like the sandpiper, but a shade larger, with a black beak three quarters of an inch long, black and white head, black breast, and white abdomen; a few white feathers between the back and the tail, some of the feathers are black edged and tipped with chocolate, others are black edged and tipped with white. The legs are red with dark marks, and the feet are likewise unwebbed. I believe it to be a turnstone. It is the first bird of this kind yet seen here.

A bird having much the flight and appearance of a swallow, so much so that the resemblance struck both Blomkvist and me simultaneously, appeared this evening. I fired a long shot at it flying, and believe it fell near the flagstaff, but hours of search amongst the boulders there failed to find it. It was probably a swallow driven here by a gale. This is not, however, very remarkable.

May 28th, Thursday.—After breakfast, when looking out of the window, I saw fly over the hut a bird dissimilar to any I have seen before here. I at once went out with my gun but it had disappeared. Thinking it might have gone west I walked about two miles west searching some pools of thaw water near the glacier, and carefully looking over all the ground. On the edge of one of the thaw water pools I found a drake eider-duck which I succeeded in shooting; it is the third killed in Franz Josef Land by us.

About 6 P.M. the doctor and I walked east with guns to continue my search of this morning, but without success. I killed a purple sandpiper. This is the first seen this year. After dinner a small bird was noticed by Fisher about the size of a hedge-sparrow, a white breast and orange or buff throat, dark brown back, with a short beak. I at once went to look for it with my gun, but it had disappeared, and could not be found. It was probably a Lapland bunting. The arrival of birds this year which were not seen at all last summer is remarkable.

May 30th, Saturday.—The country now looks very winterly again from the heavy fall of snow and drop in temperature.

I took a walk with my gun before dinner to look for new birds away east, but did not see any.

The doctor tells me that the left lower jaw of the bear I shot in Markham Sound has either been broken or the bone very much enlarged through inflammation. The canine tooth on that side has been broken, and has a decayed cavity in it, and the tooth next to it is broken also. He was a young bear.

Our cook succeeded in gaffing Fisher again to-day (for the second time) with the barbed portion of a "People's button," a box of which I had been weak enough to

give him. This was served up in the bread. Some time back when a similar thing occurred I made him return the box to me, but one barbed portion was then missing—it has turned up in poor Fisher's gum! He was very indignant. It stuck firmly in his gum between the teeth. Our cook explains that it must have come off his coat. He evidently has a roll in the dough before he puts it in the oven to judge by his usual appearance. He frequently serves up such luxuries as cinders, coal, blubber, pieces of wood, nails, &c. with the food. Fish-hooks (which the barbs of these buttons resemble) are again in season! It causes great amusement and jokes at his expense. But his work is not play by any means, and he does very well, poor fellow. We are always glad of an excuse for a laugh.

June 1st, Monday.—After breakfast I skinned the bear I shot on February 1st, which only this morning has become sufficiently thawed to enable this to be done, and the doctor gave me a hand. He and Blomkvist went on with the walrus and the bear skins. Although only partially thawed the carcass smelt very high indeed, and the doctor had to put the skin into pickle over night to prevent it going entirely wrong. After lunch I did some writing until dinner time, and in the evening washed some clothes and mended up my leather jacket. Fisher worked at his botanical specimens with the microscope. Child did various odd jobs. Armitage wrote up the meteorological observations.

It has been a most unpleasant wintry day, although the first of summer!

June 3rd, Wednesday.—About noon, accompanied by the doctor, I went out taking my gun to look for any new birds that might have put in an appearance. We ascended Cape Flora (altitude about 1400 ft.) by the

glacier, and got a splendid view. The sea to the southward is very much encumbered with very close ice, and only a long, narrow lane of water a quarter of a mile wide at the edge of the land floe, and reaching east and west as far as the eye can see, is visible. To the northward I could see no open water, although one or two dark patches near Windward Island look a good deal like it. I unfortunately had no compass with me so I was unable to take bearings, but I could clearly make out the round of the glacier near Peterhead, Koettlitz Island, the Rubini Rock, Scott Keltie Island and the coast of Hooker Island in that neighbourhood. I intend to ascend the cape again on the first clear day and take a camera with me, and also a prismatic compass to take bearings. A moderate gale from N.N.W. was blowing on the top with a considerably lower temperature than below. (A moderate to fresh wind only was blowing on the beach below.) The snow was quite dry and crisp on the top. We got back to the hut about 4 P.M.

I saw a flock of eight brent geese to-night, the first seen this year.

June 10th, Wednesday.—After tea the doctor and I walked east. I shot a Lapland bunting—a bird smaller than the snow-bunting with a yellow beak tipped with black, black head and breast, with white marks running into the black behind the head to the nostrils, a ruddy, rusty mark on the back of the neck, white abdomen, and a brown speckled back; the feet and legs are brown with a nail half an inch long on the rear toe—a handsome little bird. We saw six brent geese, but after several attempts to stalk them, and although I wounded two with long shots, we failed to bag any—they are very wary.

After dinner I washed some clothes. About 11 P.M. Heyward and Blomkvist came in to say that they had

MR. F. J. CHILD

seen a similar small bird to the one I had shot before dinner and also some geese. Taking Blomkvist with me

to show me the spot I started off with my gun, and succeeded in bagging the other one, another cock Lapland bunting, but the geese were not at home.

The *Windward* should be on her way here now. We are all looking forward intensely to news of the world by her, having heard none whatever for two years. And yet we are almost afraid to hear news. It cannot all be good.

June 11th, Thursday.—Armitage came in to report having seen three new birds near Sharpe's Rock. I, accompanied by the doctor, started out to look for them. I found them to be Lapland buntings; they are very wary now, but I succeeded in killing one to add to our specimens.

Blomkvist is not looking very well, and is a bit anæmic. I can't give him any change of food, as he, in common with all of us, is having the best of everything obtainable here. It looks ugly, however, for next winter. I lent him a gun this evening, and went for a good walk with him. He succeeded in killing two geese which has elated him very much and will do him good. We must keep them for some special occasion, such as a birthday.

The "burgie" which we got at Cape Stephen last August, and had kept in the hut all winter, died this morning. Its cage had been fixed to the front of the hut on the south side yesterday, and apparently the change was too much for it after being inside for so long.

It is the middle of June now, almost two years since we left home comfort and civilisation. Two years since we felt the clasp of a friend's hand, two years since we heard anything of the outer world upon which we so completely turned our backs. Probably now the *Windward* is coming north bearing us news. Good news let

us hope of those dearest to us. And to our joy we shall I trust get books and newspapers and something to read at last. Two years is a long time to be without any refreshing stimulus from the outside world. The longing for a new face is great at times, the ears strain for a new sound ; but week in week out our lives remain distressingly the same. Fortunately we are always busy, and are never idle. In fact, we never seem to have sufficient time to do all we want to.

June 17th, Wednesday.—I went up the talus directly after breakfast and collected a quantity of scurvy grass, sufficient for lunch and dinner. I then went on with my writing and nautical astronomy.

After lunch Blomkvist and I took a short ladder up to the top of the talus and I looked into several kittiwakes nests which are just finished. Saw no looms eggs on the ledges so I mean to wait for a few days before trying again. I afterwards went through the walrus heads and skins with the doctor. I found one bearskin on the top of a cask inclined to go wrong, so we set to work to make brine to cover them, as apparently salt alone is not sufficient.

Fisher went on with his botany. Armitage wrote up the meteorological observations.

CHAPTER XXV

A MAN ON THE ICE!

JUST after dinner Armitage came rushing in to tell me that through his field-glass he could see a man on the floe to the S.S.E. of Cape Flora, about four miles off.* I could hardly believe it, such a thing seemed utterly impossible, and thought he had mistaken a walrus on the ice for a man ; but having got a glass I could see he was correct. I could also make out somewhat indistinctly a staff or mast, with another man apparently standing near it close to the water's edge. It occurred then to me that it might be one of my own men, although they had all been at dinner a few minutes before, but I however found that all were present. I got a gun with all speed and firing off a shot on the bank to endeavour to arrest the stranger's attention, I started off to meet him coming across the ice, having placed Armitage on the roof of the hut to direct my course, as the high hummocky ice hid him from me when I got down upon the floe. On nearer approach I shouted to him and waved my cap. I thought at first that some accident had happened to the *Windward*, which had started earlier than I expected, and that this man had come off in a boat from her to communicate with us.

On our approaching each other about three miles distant from the land, I saw a tall man on ski with

* I have given the account of my meeting with Nansen word for word from my journal.

roughly made clothes and an old felt hat on his head. He was covered with oil and grease, and black from head to foot. I at once concluded from his wearing ski that he was no English sailor but that he must be a man from some Norwegian walrus sloop who had come to grief, and wintered somewhere on Franz Joseph Land, in very rough circumstances.

His hair was very long and dirty, his complexion appeared to be fair, but dirt prevented me from being sure on the point, and his beard was straggly and dirty also.

We shook hands heartily and I expressed the greatest pleasure at seeing him. I inquired if he had a ship? "No," he replied, "my ship is not here"—rather sadly I thought—and then he remarked, in reply to my question, that he had only one companion who was at the floe edge.

It then struck me that his features, in spite of the black grease and long hair and beard resembled Nansen, whom I had met once in London before he started in 1893, and I exclaimed:

"Aren't you Nansen?"

To which he replied,

"Yes, I am Nansen."

With much heartiness I shook him warmly by the hand and said:

"By Jove I'm d——d glad to see you," and congratulated him on his safe arrival. Then I inquired:

"Where have you come from?"

He gave me a brief sketch of what had occurred, and replied: "I left the *Fram* in 84° north latitude and 102° east longitude after drifting for two years, and I reached the 86° 15' parallel and have now come here."

"I congratulate you most heartily," I answered; "you have made a deuced good trip of it and I am awfully

glad to be the first person to congratulate you." (Again we shook hands.)

He then gave me a brief sketch of what had occurred. "How he had passed close to the New Siberian Islands; had entered the ice about the 80° north, had drifted for two years in a north-west direction to the 84° north and

THE MEETING BETWEEN JACKSON AND NANSEN

102° east longitude. He had then left the ship with Lieutenant Johansen (who was taking care of two kayaks at the floe edge) and a team of dogs in March 1895. They had pushed north as far as $86^{\circ} 15' 00''$ north latitude, 90° east longitude, and then judged it advisable to return and try to reach Spitzbergen *via* Franz Joseph Land. How they had passed the previous winter on the land a little to the south of our furthest point north, reached in the spring of 1895, on an island in Cecil Rhodes Fjord (named by me). There they made a small hut of stones and walrus skins near the entrance

to Gore-Booth fjord,* and had come south down the British Channel and De Bruyne Sound, and round Cape Barents, and had been lying at the floe edge off here for two days."

I replied, "I congratulate you most heartily, you have made a jolly good trip of it and I am awfully glad to be the first person to congratulate you." Followed by a good deal more hand-shaking.

I fancied by what he had said that the *Fram* was at the bottom, and that he and Lieutenant Johansen were the sole survivors. I consequently abstained from asking any further questions about the ship, and gave my fellows a hint later, not to do so, as I feared to hurt his feelings. It was not till nearly an hour had elapsed that from some remark he made I gathered that the *Fram* was all right; and that he expected her to be on her way to Norway. Owing to discrepancies in Payer's map he could not make out where he was, and they had let their watches run down, consequently could not get their longitude and tell their position. For two days they had been lying at the floe edge repairing their kayaks before we saw them.

Nansen had fancied he heard dogs barking and two gun-shots yesterday (I had fired about twenty shots at looms near the top of the talus of Cape Flora) but he had come to the conclusion that they were only noises made by the ice. He was uncertain as to the date. Finding themselves on the 80° north latitude they were pushing west, knowing that by so doing on that parallel they might hit Spitzbergen, where they hoped to fall in with a walrus sloop. After hearing the noises I have mentioned, Nansen thought he might be in the neighbourhood of Eira harbour, and that I might be there, as he knew

* Named by me after Sir Henry Gore-Booth.

something of my plans of going to Franz Josef Land, so he set off to walk to the nearest point to get upon an elevation to have a look round.

His first question was in reference to his wife, and his second as to the politics of Norway and "were Norway and Sweden at war?" He was going gamely, but looks pale and anæmic and is very fat.

On approaching our hut I told him again how delighted I was to be the first to congratulate him and welcome him on his return. Nearing the hut all my party came forward on to the floe to meet us, and I introduced them all to Nansen and told them that he had come from the $86^{\circ} 15'$ north latitude, and called for three cheers for him, which was responded to most vigorously; this seemed to please him and he repeatedly said, "This is splendid!"

I then sent Armitage on to tell Heyward to cook some food at once, and heat the bath water—of course I did my utmost to make him and Johansen comfortable.

On entering the hut I handed him a packet of letters I had brought from London for him. There was no letter from his wife at which he was very downcast, and I had again to assure him that she was very well when we left London in 1894, but a letter from his brother explained matters. He then had some fried looms, rice-pudding, and jam, and any little luxuries we could supply. (He and Johansen had lived almost entirely on bear and walrus meat for the last nine or ten months). He afterwards had a bath and I found him a change of clean clothes. I had sent all the party, except Heyward, with two sledges to bring up Johansen and the kayaks, and on his coming up I looked after him in the same manner as I had Nansen. Johansen was, if possible,

in a dirtier condition than his leader, and was as black as a sweep with dirt and grease.

Contrary to Dr. Nansen's experience, our sense of smell must have become considerably *lessened* by long absence from civilisation, for, strain our noses as we may, we fail to discover the slightest trace of the "Monkey (or any other known) Brand" about our distinguished visitors from the North.

Johansen is a short, sturdy, muscular little chap, and looks as fit and well as he might have done had he just come off a yachting trip. He hasn't turned a hair, but looks the picture of health. He is a capital fellow. Nansen and I on meeting had fired four shots in quick succession to let Johansen know he had met some one.

My fellows on approaching Johansen and seeing the Norwegian flag hoisted to the mast of a kayak had given three cheers. Johansen told one of the party in German that they were "lost" and did not know where they were, which is hardly surprising, for they had no means of ascertaining their whereabouts, as Payer's map north was unrecognisable, and they could not get their longitude owing to their watches having run down. They had a lump or two of evil-looking walrus meat and two or three draggled looking looms in their kayaks which was all the food they had with them, poor chaps. On the night of Nansen's arrival we sat up talking till 8 A.M. of the following day and then turned into our blankets, but we soon turned out again and renewed our conversation for hours. He said "He didn't want to sleep he felt so happy." I feel very pleased.

A more remarkable meeting than ours was never heard of. Nansen did not know I was in Franz Josef Land, as I did not leave England until a year after he started on his expedition, and I had not the smallest

NANSEN AFTER HIS WASH AND BRUSH-UP

idea he was then within hundreds of miles of me, in addition to that, Nansen was very uncertain indeed as to what part of the world he was in.

In the spring of 1895 I was within three or four miles of the spot where he passed the winter of 1896, and this spring again I was not far off him.

I had his letters in the little tin case with me on both occasions, although I had no real expectation of seeing him, but should have felt much annoyed had I met him sledging and had not his letters, consequently I always carried them with me.

Nansen tells me that Peterman Land, and King Oscar Land, do not exist in his opinion, and that he passed right through where the Dove glacier ($81^{\circ} 30'$) is laid down without seeing land to the north. Wilczek Land trends away to the south-east to the south of his route.

I have given Nansen my cabin and I sleep in the general room, and have put Johansen to sleep alongside of Armitage in his cabin. The doctor camps beside me on the floor of the general room.

I showed Nansen my map and he pointed out upon it to me where he had spent last winter. He afterwards copied from this map in making his own. He had fancied until just before we met on the ice that this must be some land other than Franz Josef Land on account of the absence of land marked by Payer. After his thinking he heard two gun shots and dogs barking he believed he recognised a resemblance of the coast line around here (Cape Flora) to that on Mr. Smith's map as Bell Island and Eira Harbour, mistaking however, Cape Flora for Bell Island.

They had fancied sometimes they might be to the north-west of Cape Lofley upon Gillis Land when at

their winter quarters, and that Arthur Island was Spitzbergen, and at other times that they were in Austria Sound. When off Cape Barents, finding themselves in the latitude of Spitzbergen, they decided to strike west upon it, knowing that then they must hit it if they could travel far enough to reach it. They hoped to meet walrus sloops in Hinlopin Straits. It was not until they thought they heard dogs and the two shots that they (for a time) thought they might be in the neighbourhood of Eira Harbour.

Nansen weighed to-night 205 lbs. (14 st. 9 lbs.) about a stone and a half above his normal weight. He measures about six feet two inches, or an inch taller than I am.

I photographed him on his arrival at the hut, after having a feed, at his request. I told him I expected the *Windward* any day.

June 18th, Thursday.—We had breakfast at 7 P.M. I went up the talus and shot a few looms for dinner, which we cooked with our two geese in Nansen's honour at 3 A.M. on the 19th. I showed him our sledges, furs, &c. He kindly offered to send me out one of his paraffin stoves and some "snow flake" paraffin oil to burn in it, as he thinks a great deal of it and is anxious for me to try it. This will not thicken with cold. He also wished to leave with me his kayaks and small theodolite, but of course I will not hear of this, as I should be afraid of something happening to them. It is good of him though. He asked me what he should do about the country I had discovered to the north prior to his reaching Franz Josef Land, and which he had since passed through; "he would have to give a map showing his course should he leave this blank and say that that will appear in Jackson's map?" I said I hardly knew what to reply, but we

would talk the matter over later on when we had had time to think about it. It is very decent of him to think of it: some would have published that portion of the

“NANSEN'S LARDER”

This canvas bag, about the size of a hat-box, was carried by Dr. Nansen, on his sledge journey after he left the *Fram* and contained blubber which he used for “Food, Fuel, and Light” until reaching Frans Josef Land, when he presented it to me at Cape Flora. This interesting relic now reposes in the Library of the Royal Societies' Club.

map without consulting me—at all events all they knew of it.

Nansen, helped by Child, developed one or two of his negatives, which he feared might have been damaged by salt water when a walrus knocked a hole in his kayak, but he found them uninjured.

June 19th, Friday.—All the party turned in about 9 A.M. and slept all day except Nansen, Dr. Koettlitz and I. We sat up for forty-eight hours at a stretch talking. We had sundry scratch meals of our own making, and

the time passed quickly and pleasantly. How we enjoyed the exchange of new ideas, to see new faces, especially with people with whom we have so much in common, and with whom we have such hearty feelings of sympathy. We finally turned into our blankets at about 10 P.M.

On hearing the full details of Nansen's journey it strikes me forcibly that great luck has attended his daring exploit, especially in hitting upon a spot for wintering near constant open water, both summer and winter, and consequently with plenty of game in the neighbourhood. Providence alone brought him to such a spot, failing which the end of his expedition, so far as he and Johansen were concerned, would have been very different, had he missed meeting with us—and what a marvellous meeting that was!—He could not have left Franz Josef Land; for the extension of that country towards Spitzbergen is quite unlike what Nansen and every one else believed it to be, and a stretch of practically open sea of more than a hundred and sixty miles in extent (as we found it to be in 1897) lying between Cape Mary Harmsworth and the nearest known land—White Island or Cape Leigh Smith—cannot be crossed in leaky canvas canoes. I consider a retreat by way of Novaya Zemlia, to be infinitely preferable, and Nansen and I have numberless arguments upon this point without either party changing his opinion.

I think however, it is possible that Nansen and Johansen with their great resource and hardihood might have weathered it out another winter upon Franz Josef Land had their ammunition held out—say upon Cape Neale, the most westerly point where an existence could have been maintained—where we should have found them, if alive, in the following spring.

I feel the greatest satisfaction at being the means of saving these brave fellows further perils and of sending them safely home. I only trust that Dr. Nansen's extraordinary immunity from penalty will not lead the inexperienced to suppose that one may go larking about within the Polar Circle with merely a dog and a gun, and that all things will be well with them. If they should fall into this error they will be sadly—I almost said fatally—deceived.

June 20th, Saturday.—I went up the talus after breakfast and shot twelve looms, and with Fisher's help got scurvy-grass for lunch and dinner.

I was about with Nansen all day, showing him anything I could to interest him and comparing notes. Fisher went on with his botany, &c., the doctor worked at the walrus heads, and I got the bearskin out of No. 3 hut for him to get the blubber off, and did various small jobs. Armitage and Lieutenant Johansen cleaned up Nansen's instruments, and Blomkvist tried to wash his and Johansen's clothes by putting them into water with caustic soda to begin with. They are in a fearful condition.

June 21st, Sunday.—Nansen and I went for a walk after we had breakfast, and we discussed plans for reaching the South Pole. I strongly advised the use of Northern Russian horses and describing the best method of handling and camping them out.

He gave me a pressing invitation to visit him in Norway and go elk-shooting with him. Our tastes as to sport agree entirely.

Fisher took temperatures of the soil and pond water, &c.

The weather has been cold, misty, and overcast all day, and a good deal of ice has come in from the east

with the easterly wind of last night, and Nansen remarked that he could not have proceeded on his way towards Spitzbergen with so much ice about.

Every one amused themselves as they liked.

June 22nd, Monday.—Yesterday I told Nansen that he might publish my map if he wishes to, as his route goes through the country which I had discovered a year previous to his passing through it. I am also going to offer to allow him to name the land I discovered in 1895 north of Cape McClintock, which is in the neighbourhood of his winter hut, as he has discovered very little to name, and I think it hard lines on the chap if he cannot name the capes and fjords in the neighbourhood of his hut, where he passed a winter under such hardships and privations, which until he met me he had imagined to be his own discoveries: I shall have plenty to name without these. I suggested this to him and he replied: "This is not the right thing, I know;" to which I answered: "I can't see that it matters, as it is a thing that only concerns you and me." He thanked me for being so kind, and said he would "consider whether he could accept my generous offer." I have offered him the naming of everything he could see from his winter quarters.

I did various odd jobs in the morning and after lunch went up the talus and killed ten looms for dinner, and cleaned Nansen's guns for him afterwards.

June 23rd, Tuesday.—After breakfast Nansen and I went up the talus and shot twenty-one looms. He is a good shot.

After lunch, hearing that a seal had been seen in one of the cracks off the shore, Armitage and I went to try and shoot it, but it had disappeared. We fired a few shots at a mark afterwards.

CLIMBING THE ROCKS OF CAPE FLORA IN SEARCH OF LOONS' EGGS

June 24th, Wednesday.— After breakfast I got the birch-bark canoe out of the stable store to thaw the ice out of it.

I sent the doctor with Lieutenant Johansen up the talus to enable him to have a little sport loom shooting, as he seems fond of it. Blomkvist and I went up the rocks to get eggs. We succeeded in collecting seventeen looms' eggs and twenty-seven kittiwakes'. We did not return until 6 P.M. We found the rocks very loose, which rendered climbing rather dangerous. Heyward, who had gone to fetch water about 8 P.M., returned to the hut somewhat in a hurry, saying that he had met a bear on the top of the slope which had run towards him. I asked Nansen if he cared for a shot, and giving him my rifle and I taking my camera we started out. I went ahead, and our friend at first came towards me hissing loudly, but evidently thinking discretion the better part of valour beat a retreat. I got one negative, and then as she seemed like going off, Nansen wounded her in the hind quarters and checked progress. I then ran up and took one negative after another, but as she made two or three vicious rushes at me, Nansen thought it was time to put a break on her enterprise, so popped another bullet through her left shoulder, cracking the bone. I then ran up close to her, as she stood hissing and snapping, and took more negatives, with the dogs barking around her. I sent for my revolver and fired two bullets into her muzzle, aiming at her head, which only had the effect of enraging her still more, and seizing "Misere" in her teeth, she threw him over her head, and caught "Nimrod" by the right fore foot and tore a nasty gash in it. As I could see that using a revolver upon her was simply torturing her, I asked Nansen to finish

her with the rifle, which he did. We then sledged her up to No. 2 hut to be flensed. She was a fair-sized she-bear. I sent this skin to Mrs. Nansen by her husband.

June 25th, Thursday.—After breakfast Nansen and I did a little photography. He took two or three negatives of me in the hut, and I returned the compliment by photographing him.

After lunch Blomkvist and I went up the talus to get more eggs, accompanied by Nansen, who wished to take some negatives of birds on their nests. We took a second short ladder to lash to the first to increase the length. Nansen returned to the hut with a negative or two, which I took for him from the top of the ladder. Blomkvist and I secured eighty-eight kittiwakes' and four looms' eggs, getting back about eight o'clock.

June 27th, Saturday.—Nansen and I walked out to our meeting-place on the floe to the S.S.E. to be photographed at the scene of our extraordinary meeting on June 17th. Nansen re-dressed himself exactly as he was on that occasion, and in every way the scene was exactly reproduced, excepting that his hair and beard had been cut, and he was in a more cleanly condition. I put on my brown leather coat, breeches, high leather boots, and round woollen cap, and carrying my gun as upon that occasion. "Misere," the dog that went out with me then, was also included in the group. We got back about 6 P.M. Nansen and I took a number of photographs on the way.

Johansen seems a splendid little chap, but I don't speak Norwegian, unfortunately, and his English is rather embryonic at present. He is studying hard at it.

June 28th, Sunday.—After breakfast I traced in a

'NANSEN AT CAPE FLORA

map made in 1895. Nansen went on with his observations.

Armitage, the doctor, and Fisher, went on ski to Cape Gertrude. They saw there two divers, probably the red-throated variety, but failed to get a shot at them. They returned at 11 P.M.

After lunch Nansen and I went up the talus and shot seventeen looms.

Nansen appears to be very anæmic and out of condition. Three years in the Arctic has evidently taken the vigour out of him for the time. Climbing the talus pumps him very much, and he doesn't like it a bit. He has had, poor chap, a very rough time of it, especially during the last fifteen months, and all the care, responsibility and worry, which falls to the lot of a leader of an Arctic expedition in addition to it. Johansen certainly looks better, but the latter causes of being out of condition have been absent in his case, as he has had no responsibility.

June 29th, Monday.—During the morning I worked at the maps and Nansen went on with his astronomical observations. Armitage walked through Windy Gully with a rifle. He saw a fox, but could not get within three hundred yards of it. The doctor went geologising and came across a number of sandstone fossils. These were at the southern end of Windy Gully, on the left hand side, looking north. It is a high shoulder, about three hundred and fifty feet high, where a small expanse of sandy clay shale with a few fossils embedded in it can be seen. The sloping surface of the shoulder is strewn with fragments of a hard grey, fine sandstone, which is red where exposed to the air, and among which were found very good specimens of scriptoriosis of a large belemnite, shells, and other fossils. After lunch I sent

the doctor and Fisher to get all the fossils they could, and Nansen accompanied them to see the spot and collected some also. Blomkvist and I went up the talus to get more eggs. I obtained forty-seven looms', three kittiwakes', one rotche, and two "burgomasters'" eggs. The burgomaster, on my approaching the nest, covered up the eggs in the nest with moss. Fisher, a day or two ago, when botanising, found the nest of a purple sandpiper. It was merely a hollow in the ground in a swampy spot. There were four eggs in it which are very large for the size of the bird ($1\frac{4}{10}$ of inch by $1\frac{1}{8}$ inch); olive-green ground marked with chocolate and pale chocolate patches, larger and more numerous at the larger end of the egg. The hen bird showed great anxiety on Fisher's approach, and endeavoured to draw him away from the nest by a variety of antics, in the same way as skuas and plovers do. The eggs are somewhat plover-like in shape, but not quite so peg-topped.

From the rocks I could see much ice in the sea but none to the eastward of any extent, all of a loose description with plenty of water between. I could see nothing to stop a ship's progress in that direction, but it is impossible to say what ice there may be in the sea further off the land.

* *July 6th, Monday.*—Overcast and misty all day, with winds W.N.W., W. and W. by N. Forces 2 to 3.

I did some shovelling in the morning around the hut, and spent the rest of the day writing. Nansen went on with his map, which he is drawing from mine, and I have placed everything unreservedly at his service. He asked me about naming a cape after Armitage and a rock after Blomkvist in the large bay in the neighbourhood of his hut, as he has accepted my offer to name

LEIGH SMITH'S HUT AND PLATEAU TO THE EAST OF OUR HUT IN JULY

everything he could see from his winter quarters.* Should he do this? I told him I thought it very kind of him.

I sent the doctor, with Johansen, up the talus to shoot looms after lunch. They only brought back three, after firing twenty shots, for which the poor doctor got much chaffed. They were evidently a little out of form to-day.

July 7th, Tuesday.—Nansen has been mapping and writing a telegram. I made a tracing of Nansen's map after he had completed it with mine.

July 10th, Friday.—After breakfast, the day being clear, sunny, and little wind I took my cameras, prismatic compass and stand, and the doctor and I ascended Cape Flora by the glacier to photograph, take angles, and collect anything of interest. I took a number of photographs, made sketches, and took bearings. The view from the summit was a very fine one, showing Capes Grant and Stephen in the distance with the high, white country behind overrun with ice, and Bell Island and the beautiful little Mabel Island nearer at hand. Bruce Island covered with its ice-sheet with the exception of a few projecting points of rock near the coast, and Windward Island now showing a good deal of bare soil and rock. To the northward we could dimly make out the curves of the ice-clad country to the north of Peterhead. Even Koettlitz and Scott Keltie Islands could be discerned.

When returning, upon a nunataklike projection about

* On reading Dr. Nansen's book "Farthest North," I find he has only availed himself of my offer so far as naming one of these spots—Frederick Jackson Island—after me, which I should never have consented to had I known of his intention to reject the rest. Reading his book was the first intimation I had of this.

six hundred feet above the sea, we found a number of plant fossils in crumbling sandstone lying loose upon the surface above the basalt. They appear to contain the leaves of a pine, with some seeds, and in one a cone was visible, also the leaves of a Ginkgo, which indicate that they belong to the Jurassic formation, and that

THE CAIRN ON THE SUMMIT OF CAPE FLORA, AND DR. KOETTLITZ

Franz Josef Land once had pine forests, and a much warmer climate than to-day. It is difficult to imagine this bleak ice-covered land once clad with ferns and waving pines, where to-day nothing higher than six inches grows; but such was the case. As Dr. Nansen has described these fossils in his own book, it is needless for me to do so.

July 11th, Saturday.—After breakfast Nansen and Johansen, dressed in their sledging clothes, took their kayaks and sledges down to a fresh water lake on the

floe and rigged them as when travelling. I carried down three cameras and took about fifty negatives of them sailing, paddling, and dragging the kayaks, sledges, &c. This occupied us until 5 P.M., when we had lunch.

July 12th, Sunday.—In the morning I wrote up and packed away a number of negatives and then went for a

YOUNG PURPLE SANDPIPER

walk west. The doctor took Nansen to see some geological formations of interest and to collect fossils. I have told my chaps to give Nansen all the information and help in their power in every way.

July 15th, Wednesday.—Fisher did some botanising and found two new fungi and two young purple sandpipers in the down. It has been overcast and very misty all day with light and gentle breezes from north-west, N.N.W., and north by west.

July 16th, Thursday.—Nansen handed me his telegram to Scott Keltie to go to a newspaper, and asked me to

revise and straighten up the English for him. This I spent the day in doing as I wrote it all out again, and there were five and a half sheets of foolscap.

July 20th, Monday.—I wrote during the day, and after lunch Nansen and I went up the talus and shot looms. I picked a pet “hot corner” on my preserves for his benefit. We shot alternately and killed twenty-eight looms, but might have shot many more. I also got fourteen looms’ eggs off the rocks. The mist cleared when we had finished shooting and gave us a glimpse of the ice. There is a great deal of it in the sea, but it is not very tight and shows a water sky on the horizon. I am getting rather anxious about the ship. Did the *Windward* reach home safely last year? and will she be able to get through the ice and reach us this? I think she will, but time is passing and there is no sign of her. Nansen and Johansen await news by her as anxiously as we do. I hope it may be good news for all of us.

July 21st, Tuesday.—Nansen is an ardent politician, and is always “spoiling” for an argument on politics. I abstained from political discussion as much as possible, as our views on the subject are diametrically opposed to one another. He is, however, very patriotic and his great desire is the advancement of his country. In this we are at one. Differences of opinion as to methods perhaps matter little. Subjects of Her Majesty when at home do not realise how loyal at heart they really are. They have so many objects of interest to daily distract their attention; it is in the loneliness of life, when cut off from all news and communications with the world, and in strange lands, that we really appreciate how much it means to us. So it was with us, and so it is with many thousands of good fellows in

THE LOWER TIER OF ROCKS OF CAPE FLOKA

far corners of the mighty Empire of which we are all so proud.

It is by daily intercourse and intimacy with Nansen that the conviction is borne home to me how arduous and heart-breaking was the life he and Johansen endured on that lonely and trying sledge journey.

On the 14th of March, 1895, they left the *Fram*, and on the 17th of June, 1896, we found them on the ice floes off Cape Flora—fifteen months—during which they

SUMMER IN FRANZ JOSEF LAND

had travelled about seven hundred miles. It does not sound a terrible undertaking; but to us here, with our experience of Arctic sledging, it appeals with grave significance. Nansen repeatedly remarks that nothing will ever induce him to undertake such a journey again; and I feel with him, and for him, that one such sledging expedition may well suffice for one life-time.

It is summer, but the weather is hardly what in more favoured climes would be considered summer-like. The thermometer hitherto since we arrived in Franz Josef Land has not risen higher than 8° above freezing point, and only has attained that degree of warmth on two or three occasions at long intervals. It is misty and raw,

and the atmosphere fully charged with moisture. At intervals a drizzling rain has fallen, changing to snow, and towards noon the easterly wind increases in force to a gale with heavy snow. The country is white, and everything looks winterly. This is too frequently the character of "summer" days here. At long intervals the aspect changes. The sun comes out, the sky clears, and the mists roll away for a time. The "cawing" of the looms recalls green meadows and tall elm trees; and we sit in the sun like crickets upon a wall, and declare that "it is quite hot to-day," having quite forgotten what a warm day really is like.

July 24th, Friday.—After breakfast Johansen and I went on ski to the northern end of Windy Gully, as I wished to place the jaw-bone of the whale—fellow to the one we previously sledged to Cape Flora—in position to fetch away next autumn or spring, when the ice is again in condition for it. It lies about three hundred yards from the water's edge, and at an altitude of nine feet above the present sea level. They belong to the *Balæna Mysticetus* or Greenland Right whale, which undoubtedly once lived in these waters. I found several new species of shells on the ice (probably dropped by birds) and on the beach there. The ice is in good condition for ski-ing, the snow on the floes having all melted, or the little that remains is now in a coarse, granular condition, over which ski glide easily. The frequent water channels and wide open cracks make jumping often necessary.

Nansen and the doctor went geologising. Fisher botanised. Armitage is taking a series of magnetic observations. The doctor in the morning packed up and labelled the geological specimens, on which he is spending the utmost care and trouble. Child finished making

some hyposulphate of soda for photography, of which we have quite run out.

July 25th, Saturday. — I went up the talus, and climbed about the lower tier of rocks to get a look at the ice off the land. From the S.S.E. to E. there was little ice visible. To the south the ice appears to be of the

OLD JAW-BONE OF THE "BALÆNA MYSTICETUS"

light, "sailing" ice" variety, but from south to west a close pack lay with a few "streams" of water in it; but beyond it I could see a "water-sky" on the horizon. No sign of the ship for which we are anxiously looking.

The doctor and Nansen have gone out geologising, as the doctor wishes to show him a new bed of fossils he has found.

A shoulder projecting from the rocks of Cape Flora about three hundred feet high, composed of the sandstone formation series, shows a section on the southern

side in which are white, chalky fossils, possibly belemnites, upon the surface above which, inclined at an angle

A view of the lower tier of the dolerite rock-mass at the west end of the cliffs of Cape Flora, which is here much broken up, in places being covered with talus, and in others standing out boldly from it. Stratified-looking volcanic mud or tuff, mixed with brown shale, is peculiarly enclosed by dolerite rock.

of 16° , are strewn numerous pieces of grey sandstone, hard and compact, which has a red surface when exposed

to the weather, in which (and also lying loose) are ammonites, belemnites, and other fossils.

Five hundred feet up the talus at the back of the hut is an exposure of the same sandstone series, consisting of clay shales and compact clay sandstone. Down a water-course running from it are many fragments of this clay sandstone, in which are embedded ammonites, belemnites, &c. Above this series is a layer of dolorite: of a vesicular, amygdaloidal structure, above which is a small layer or stratum of the clay shale. Upon this is coarse, tuff-like rock; and then come the main basaltic rocks of the cape.

July 26th, Sunday.—At 4 A.M. Blomkvist, who had stepped outside the house for a moment, woke me and told me that the *Windward* had arrived. News from the world at last! I turned out, and saw her making fast to the floe-edge off Flagstaff Point. I at once told Nansen and called the others, and hurriedly dressing myself, started across the floe on ski towards her, accompanied by Blomkvist. It was then blowing hard from the east, with a heavy fall of rain, and this weather lasted throughout the day until night. Coming across the ice I saw Wilton, whom I had met in Archangel, and a Mr. Bruce, with several sailors. My first questions were in reference to my mother and our friends in England, whom I was told were all well, except Armitage's mother. I then inquired if Frau Nansen and Alexander Nansen (the explorer's wife and brother) were in good health, and on receiving an answer in the affirmative I sent Blomkvist to tell the good news, as I knew the poor chap was anxious about his wife. I wished I could have sent the same good news to my own men, but the sad death of Mrs. Armitage forbade this, and I thought it better to say nothing further at present.

On seeing Captain Brown I was much grieved to hear of the death of Armitage's mother ; and it became my duty, the saddest I have had to perform for many a long day, to break it to him. I received and distributed the letters, and we all spent the day reading them. We all had dinner on the *Windward*.

Four reindeer have come, but they cannot be usefully applied to sledging here. They are quite useless to me here.

Owing to the terms upon which Captain Brown and his officers have been engaged (chiefly by bonus on condition of the *Windward* returning by November 15th this autumn), I have been obliged to relinquish my plans for exploring in her. Useful dredging and sounding and other good work might also have been effected had this been made possible. I am pleased to renew my acquaintance with my genial old friend Captain Brown. We had been shipmates together as far as the Yugor Straits in 1893, when I explored Waigatz and the Bolshaia Zemelskija Tundra country, and it was with sincere pleasure that I met him again on the deck of the *Windward* in the far north. For I feel that he is not only a pleasant companion, but a sailor in the true sense of the word and a man into whose hands the safety of the *Windward* may be fairly entrusted.

How we all talked ! What numberless questions we asked ! We heard of the war between China and Japan, the gallant defence and relief of Chitral, where our countrymen exhibited such bravery with Sir George Scott Robertson at their head ; of the wondrous X rays, and colour photography, and a hundred and one other things, which more than two years total absence of news had accumulated. Then our letters and newspapers too. How we devoured their contents ! and our hearts were touched

by the kind friends who had remembered the absent wanderers, and had sent them a word or two of encouragement and assurance that they were not forgotten. Many useful presents also reached us. A musical box from one friend which will delight our ears and recall scenes of home during the darkness of winter; a Christmas pudding and packets of books from others. We heard of friends who have gone, whose kindly faces we never more shall see, and whose hands we have clasped for the last time. Friends, whose help and encouragement had come to my aid in my struggle to organise this expedition when encouragement was scanty, and long before Mr. Harmsworth generously came forward to my help with the necessary funds and the Expedition became an accomplished fact. The arrival of the *Windward* was a mixed pleasure indeed.

We heard, too, of the difficulties and dangers the *Windward* had gone through on her way home in 1895. How she became beset in the ice to the south and was locked in its unrelenting grasp until the beginning of September, and narrowly escaped passing another winter there.

We heard that to effect her escape it was necessary to burn all available timber in the ship to use as fuel for her engines to force her clear of the pack. That two deaths occurred on the way home, and much sickness after she left us and before she at last reached Vardo. Captain Brown was most hospitable and anxious to make us comfortable. The little steward, Else, too, in common with every one, in his cheery manner is most obliging and kind, and tireless in his endeavours to give us the best of everything, and to attend to our comfort generally. Both he and Captain Brown have been very energetic on the voyage in sounding and

using the drag net, and have quite a collection of marine life on board.

July 27th, Monday.—After breakfast I took all of my party down to the ship and together with the crew we set to work to first of all make a track through the rough ice with picks and shovels and then sledged goods ashore, having first of all brought up to the hut the four useless reindeer which had been sent in place of ponies. We worked at this all day, having lunch on board to save time.

July 28th, Tuesday.—After breakfast I started all the land party to work carrying all stores liable to be damaged by wet up the steep slope by the flagstaff to the hut. At this we worked all day. The crew continued sledging goods from the ship, and by night had landed all stores and a good deal of the coal. A reindeer died this afternoon. Sending them is a very sad mistake. All my hopes and expectations of receiving ponies have come to naught. People at home have possibly acted for the best, but it is a great disappointment to me, and the omission heaps difficulty upon difficulty. I had been building my hopes upon them. I *do* know what I require here.

August 4th, Tuesday.—During the night the *Windward* shifted her moorings and steamed we believed up Miers Channel to avoid ice. But the thick weather quite prevents us seeing where she has gone. I have been writing hard all day and have this evening completed everything and there is now nothing to keep the ship another hour. The doctor has been packing up geological specimens all day. Fisher has kindly set to work to develop some negatives for me, which I wish to send home. Wind E.S.E. force 5 to 6. At 4 P.M. south force 4. At 8 P.M. south force 2 to 3. Overcast, misty,

three hours snow and one of rain. It snowed all last night and there is to-day a heavy fall on the ground and deep drifts. It looks quite like winter again.

To-day we have all been working hard stowing away the stores which have arrived by the *Windward*, the doctor excepted, who has been packing up geological specimens to be sent by the ship, as I wish as many as possible to go. Another reindeer died this afternoon apparently from the same cause as the last one. It is a great disappointment not to get horses, and these reindeer are worse than useless. I had pointed out the unsuitability of even well trained reindeer for use in Franz Josef Land.

There appears to be plenty of open water a short distance off the land floe but there is a good deal of ice in the entrance to Gunter Sound.

Overcast, misty and three hours snow. Wind W.S.W. and W. 6 to 7.

August 6th, Thursday.—I have told Captain Brown that I wish Blomkvist to travel a'ft and not to be sent into the forecastle as I fear he might be if I did not make a point of it. He has asked me to allow him to return home as he fears his health will not stand a third winter here. He has written me a very nice letter thanking me for my "great kindness to him." I am sorry to lose him as I have found him a capital fellow, with whom, from first to last, I have not had an unpleasant word. He has done his duty well and to my entire satisfaction.

I have been busy at a variety of jobs, and in the afternoon Armitage, Wilton and I began to carry the bags of coal which had been brought on shore, up the icy slope by the flagstaff on to the plateau. But as they weigh over a hundred pounds each, we find it a bit too much of a good thing to carry them up slippery ice at an

angle of 45° , so we haul them up with a line attached to a 9 ft. 6 in. sledge, hand over hand, and in this way get on better.

It has been blowing W.N.W. force 3 to 6 until 6 P.M. when it became north-west-by-west, force 3. Overcast, misty all day with two hours snow. At midnight the *Windward*, which had been obliged to leave the floe edge owing to the southerly on-shore wind, came a little nearer to us and was tied up to the floe beyond the west point. It is remarkable that a southerly wind of force 6 should have come on to blow while she was here, for a wind of that force from that direction is very uncommon (only once before has it reached force 5). This brought a good deal of ice in, and obliged her to leave the floe edge and finally forced her up Gunter Sound where it has blocked her in with only two feet of water under her keel. I feel very anxious about her. If she had a little more steam power she would not remain there an hour longer than she wished to, but she steams slower this year than in 1894, and won't do more than three knots. Nansen does not appear to wish to go on to Christiania in the *Windward* but to land at Vardo and take one of the mail steamers on. I have told him I only wish to consult his convenience, and of course he can do as he wishes.

I have requested Captain Brown to wire Harmsworth for permission to take the *Windward* on to Christiania and having received his permission to offer to take Nansen there and then be guided by his wishes entirely.

August 7th, Friday.—About 12.45 A.M. the *Windward* could be seen pushing her way amongst the ice and proceeding down Gunter Sound near the coast of Mabel Island. As she came nearer us we took all the geological specimens (five cases) the doctor could get

packed, together with the baggage belonging to Fisher, Nansen and Johansen, and proceeded to sledge them across the now very rotten land-floe towards the water's edge. Fisher is returning as his term of engagement (two years) is now up, and he has practically finished the botany here. He has worked most enthusiastically and

"AND PROCEEDED TO SLEDGE THEM ACROSS THE NOW VERY ROTTEN
LAND-FLOE TOWARDS THE WATER'S EDGE"

hard, not only at this, his special department, but at the zoology or anything that came to hand. He has made valuable collections and sketches of minute life. I am sorry to lose him.

A boat put off from the *Windward* but landed too far West, where the distance was much greater and the ice much too rough to take a heavily loaded sledge over. Nansen, Johansen and the doctor managed to reach the boat with her crew, intending to pull round the point and meet the sledge there. The ice came down fast, however,

from Miers Channel and drove fast east along the floe edge cutting the boat off from us. The doctor managed to return over the driving pack after a rather risky and troublesome walk. Nansen and Johansen also started back to say good-bye to me but had to return to the ship. Nansen, Johansen and I have been capital friends, and I

"AND PUT THE SPECIMENS, MAILS AND BAGGAGE ON BOARD"

part with them with regret. About 6 P.M. slack tide came on, and a lane of water opened through the pack leading to the land floe; we again ran out our sledge, and were met at the water's edge by the mate and a boat's crew with a whale-boat, and put the specimens, mails and baggage on board. Nansen has offered to send my wire to Mr. Harmsworth from Vardo, and, as I wish to avoid any possibility of clashing with his telegrams, I have handed it to him to do so. He prefers, he tells me, to send his cable first to Mr. Scott Keltie and then mine

to Mr. Harmsworth, and after that a longer wire of his own to Keltie. Three of the crew, including the cook, have applied to me to allow them to join my expedition and to remain here. However, I have no need of further men, and had to decline their services.

The ship left about 6.30 A.M. with repeated cheers

THE "WINDWARD" LEAVES US FOR THE SOUTH

both from the ship and the boat's crew, and responding cheers from ourselves on the ice. I sent a present of pipes for the ship's company by the mate. They have worked well, and have been most obliging and nice. We regretfully watched her slowly depart and wished that we had finished our work and could go with her. This will take another two years as I intend, after completely mapping in Franz Josef Land, to try a shot over the floes to attain as high a northern latitude as I can to the west of Nansen's route, as that was part of my original plan.

I can see very little ice off the land. About 8 A.M. we could just see the ship bearing S.S.E. from Cape Flora under sail with a gentle N.N.W. wind. The sky had cleared then eight-tenths and there was no mist to seaward. She should make a good voyage, I think, as there is apparently slack ice to the south.

We had a little food and turned into our blankets until 3 P.M., I then set to work to thoroughly clean out the hut and to straighten things up generally.

Wilton has to carry his arm in a sling, having poisoned his hand on the way here, but is able to feed the animals and do light jobs. We have only had breakfast and dinner to-day so as to enable us to get level with the day again. Although the sun circles round the heavens all the twenty-four hours still without setting, yet owing to its low altitude after 6 P.M., and the high rocks of Cape Flora to the north placing us in the shade, the thermometer generally falls below freezing point during the night. We get so little warmth here, that we are anxious to benefit by all there is, and on that account avoid as much as we can turning night into day, although our invariable tendency is to do so. We frequently find ourselves having breakfast at four o'clock in the afternoon, lunch at 10 P.M. and dinner at 4 A.M. of the following day, owing to having worked all through the previous night, much like the weird creature referred to in "The Hunting of the Snark." We then by sitting up for twenty-four hours contrive to get right again with the day, but we soon get day and night topsy-turvy again.

CHAPTER XXVI

THE DARKNESS OF A THIRD WINTER IS UPON US

August 8th, 1896, Saturday.—After sweeping out the house as usual I went up the talus and shot eighty-one looms for the winter larder. Heyward and Wilton came up later in the day to help me carry them down. These we hang up to a rope stretched round the roof of the hut, where they freeze at once.

August 9th, Sunday.—After doing our usual domestic work I went up the talus accompanied by Armitage, Wilton and the doctor to pick up the birds as I knocked them over, and shot one hundred and twenty-eight looms. I could see only a little drift-ice in the offing.

August 10th, Monday.—Another reindeer died this morning of no very apparent cause, I took a rifle to shoot the remaining one to save it for the larder, but as it appears to be in better health and stronger than the others, I abstained, and have decided to give it every chance. I expect it will die soon, however. Nothing but reindeer that have been brought up from fawns to eat artificial food, less bulky and more nutritious than their natural lichen, and accustomed to be penned up, as I had experienced before I started on this Expedition, are of any service. These animals, I believe, are pining to death. They are young animals which have never been in a sledge and are as wild as hawks. I cannot carry the lichen sent by the ship, sledging, especially drenched as it is with water and frozen solid, and it is

impossible to dry it here. This lichen having got musty they won't eat it readily but waste fifty per cent. of it. After we had done our usual morning's work I went up the talus and killed a hundred and nineteen looms, I was accompanied by Armitage and Heyward, Wilton following later to help to pick up the birds and to put them into sacks as I shot them. It was snowing all the time we were up there.

August 11th, Tuesday.—Wilton's hand is better, but it hampers him in doing work, although he is very willing, and would soon have it very bad again if I allowed him to do all he is anxious to.

I have arranged with Armitage to take a weekly series of magnetic observations through the winter, and also to take daily the magnetic declination. Without a copper oil-stove to warm the observatory, owing to the freezing of moisture on the instruments, accurate observations are carried on under the greatest difficulties. Unfortunately a stove for this purpose was omitted to be sent by the ship this summer. Armitage has been able to get a small copper Norwegian lamp which he hopes to be able to make answer the purpose.

August 14th, Friday.—After "sweeping up" I went with Armitage and hauled out our two small boats—which we had put into the water to swell the timbers, as they were being rapidly frozen in. I then went up the talus with Armitage, Wilton and the doctor, and shot one hundred and twenty-eight looms. The doctor killed one of the sheep, which had been put on board at Vardo. I felt very reluctant to have this done as they are such nice friendly animals, following one about and have become pets with all of us—but necessity obliges—as I want the hay for the pony.

After tea we hauled more coal up the slope. The

sacks of coal we find very troublesome to handle owing to their excessive weight (coal in bags to be landed at

LOOMS ON THE ROCKS

such spots as this ought not to exceed fifty-six pounds each).

A packing-case (no contents marked upon it) turned

up to-day containing the tubes of the Thompson sounding machine on board the ship. It was labelled "Land Party." Many articles expected have not come.

August 17th, Monday.—After breakfast we set to work to remove the old felt and to clear out the dust and dirt, and then lay down the thick felt with the new oil-

HAULING COAL UP THE ICE-SLOPE

cloth over it. Unfortunately only half as much as is required has been sent to cover the whole floor, but we are using tin cut out of old meat-cans for carpeting to make up deficiencies. Armitage and Wilton rigged another block and tackle to haul coal up the ice-slope by the flagstaff.

August 24th, Monday.—Some lines for fish and a large tin with meat as a bait for shrimp and other water life were set to-day. However, at midnight only a few shrimps were caught.

August 25th, Tuesday.—After breakfast Wilton and I took my canoe and sledge and went across the floe to

the pools of water. I shot eighty old looms and twenty young ones, and captured a number of young ones alive, which I brought back to be labelled, as it will be very interesting if these are captured south or killed elsewhere. We cut out a small copper label with a J stamped upon it, and tied it to the young looms legs; afterwards they

LOOM-SHOOTING WITH BIRCH BARK CANOE

were put into the sea so as to give them a fair start. The copper label was attached with very strong fishing line to nineteen of them.*

Armitage fixed a new line round the hut to hang birds on for the winter, as the old one has given way twice.

August 26th, Wednesday.—About 8.30 A.M. hearing the dogs barking I sent Heyward out to ascertain the cause. He returned reporting a large bear near the

* Up to going to press none of these have been heard of (December 1898).

reindeer hut. I took my hand camera and rifle, Armitage followed me. On going round the reindeer-house I

LOOMS AND YOUNG IN A WATER-HOLE IN THE ICE-FLOES

came upon the bear suddenly eight yards off, and got a very satisfactory snapshot at him with the camera, for he

"On going round the reindeer-house I came upon the bear suddenly, eight yards off"

"As he had got a trifle too near to be quite pleasant"

"And stopped his further advances with a bullet in the head"

did not notice me as he was looking at a dog that was yapping at him. On his discovering me through the click made by the camera he came at a rapid rate towards me, manifesting distinctly malicious intentions towards the aggressive photographer, and had approached within three and a half yards of me before I could get another hurried snap at him with the camera, when, as he had got a trifle too near to be quite pleasant, I backed a couple of yards to where I had placed my rifle on the ground, and stopped his further advances with a bullet in the head which knocked him over. He, however, managed to half raise himself and scramble towards the bank which has a steep descent to the sea. Fearing he might slide down it and thus give us trouble in hauling him up again, I asked Armitage who had come up to stop him. His bullet, however, did not appear to influence him much, so I gave him another in the neck which finished him. He was a tall, leggy bear, but to our surprise only measured 6 ft. 9½ in. from the nose to the root of the tail along the back. He looked much larger. The second negative taken at three and a half yards distant is a trifle "fuzzy" owing to the hurried way in which it was taken, and the bear is partly out of the field, owing to my having to judge it. He was a trifle too near to enable me to take my eye off him and to look into the "finder" of the camera. I just got his head and back in.

The doctor and Wilton skinned him after breakfast.

Wilton managed to catch a snowy owl, which was evidently very sick—due to a charge of shot, I think—this evening. We have put it into a rough cage hoping that it may recover.

Winds N.N.W., N., and E.S.E. force 1 and 2. Sky clouded from ⅓ to ⅔ths.

August 27th, Thursday.—One bear seems to bring others! Armitage came in just before we sat down to breakfast to say that a large one was feeding on the blubber of a walrus I shot yesterday. I took the half-plate camera (as he showed a strong objection to leaving his find of food, and I thought he would prove a good

THE PHOTOGRAPHER PHOTOGRAPHED. A SNAPSHOT BY MR. ARMITAGE

sitter), my hand camera, and rifle, and called the others to follow me to see the fun. When I got out he had left the blubber, having eaten as much as he could cram down, and was lying at some distance from it, evidently with the intention of camping until his stomach would admit of its taking in a little more. It was amusing to watch his anger when the Ivory Gulls ventured to help themselves to a little of "his" meat, and every time they settled near to it he at once chased them off. I took a number of negatives of him with the telephoto lens at a distance of sixty yards or so, when Armitage took a

snap at me with my hand-camera while so engaged, and then taking my hand-camera, I went down on to the floe, followed by the others. He at once came angrily towards me, evidently thinking I intended to take his blubber from him, and I took one negative after another at about seven yards distance, as he stopped at a crack and stood hissing and snarling at me, and gave me a splendid opportunity of photographing him. After exhausting all my films I called the others up and we gave him a volley which finished him up, poor old chap. It seemed rather too bad to shoot him after the amusement he had afforded us. He had been lying about on the ice, looking for all the world like a drunken man after a feast, and was much the shape of Andrée's balloon. His stomach was enormously distended, and the contents ran out of the œsophagus on its being cut near the root of the tongue in removing the skin. The contents weighed sixty-five pounds. In spite of this he several times tried to get more down, and was exceedingly angry with any bird that attempted to get a picking. He measured seven feet seven and a half inches from the nose to the root of the tail.

After this bear entertainment we had breakfast (2 A.M.) and I spent the rest of the day developing the negatives; the others skinned the bear and sledged the meat up to the floe-berg, to be added to our larder on the roof by-and-by. It has been calm all day, with nine-tenths of the sky clouded.

August 28th, Friday.—After breakfast, as it was calm and sunny, I took a number of negatives. Wilton and I then went up the talus, and I took several more with the half-plate and hand-camera of birds upon the cliffs, and then with a ladder and landing-net caught seventeen kittiwakes (three were old birds and the

rest were young ones) to the legs of which I attached copper labels (J), and a strip of red cotton to the neck to attract attention if seen in Europe or elsewhere.

Armitage fitted up the whale-boat ready for dredging

SNOWY OWL

to-morrow if the ice and weather are suitable, to obtain specimens of marine life.

August 30th, Sunday.—After doing a few odd jobs I set to work to remove the shelves, pictures, &c., in my cabin, and to caulk the walls, and then put a covering of the thick loose felt and another of tarred, from our new stores, under the green felt, in the hopes of remedying the wet condition the room has been chronically in by making it warmer. This took me until 9 P.M.

Wilton walked to the northern end of Windy Gully to look at the lines and trap, but nothing except a

few shrimps were taken. The others amused themselves as they liked.

September 2nd, Wednesday.—Soon after breakfast I spotted a bear on the floe which had been feeding on the blubber of the walrus I shot a week ago. I took my rifle and camera and called to Armitage to follow me. I went along the beach past Eira Cottage as the bear was

“I FINISHED HER WITH A SHOT IN THE NRCK”

sauntering along east, and finally heading her off, got near enough to take some negatives. I continued taking them whenever opportunity offered, and at last she came towards me hissing and showing every inclination to charge, but unfortunately the click of my camera in changing the film made her alter her mind and she made off. She kept her hind-quarters directly towards me, and I allowed her to go some distance in the hope she would show her flank, but as she still kept dead ahead I shot at her backbone a little above the tail and succeeded in breaking the spinal column and knocking her over. Armitage then shot her through the right

thigh. After again taking a snap at her with the camera, as she sat on her hind quarters hissing and snarling at me, I finished her with a shot in the neck. It was curious to see her, when crossing thin ice, scramble along upon her stomach spreading her weight over a greater surface to prevent her going through.

"WE THEN TOOK TEN OF THE DOGS AND A SLEDGE OUT, AND HAVING SKINNED HER, BROUGHT THE SKIN AND MEAT UP TO THE HUT"

We then took ten of the dogs and a sledge out, and having skinned her, brought the skin and meat up to the hut, ferrying the dogs, men, sledge and meat over the lane of water in the twelve-foot Norwegian boat, which we carried down the steep slope for the purpose.

September 3rd, Thursday.—I mended my hand-camera after breakfast, as I discovered that, owing to the wood having shrunk near the "finders," it was admitting light, and this accounts for the fogging of negatives taken with it recently, which had much puzzled me.

We then all set to work to haul coal up the ice-slope, and stacked the bags of reindeer moss, which has become frozen down upon the ice-foot.

Winds N.N.W., W.N.W. and N.W. 1 to 4. Sky clouded $\frac{6}{10}$ ths to $\frac{7}{8}$ ths. Rain band 0.5. Fine snow falling at times after noon.

September 4th, Friday.—After breakfast I set to work to make a wheelbarrow, using the trahometer wheel for the purpose (which is now useless for measuring distance, as a recording instrument for it has not arrived by the *Windward*.)

Bruce went on with the zoological work, with which I am helping him in every way in my power.

September 5th, Saturday.—The doctor this morning is suffering from what he believes to be ptomaine poisoning, and I am also feeling distinctly chippy. His face is much swollen and rather inflamed, and he is anything but well. This we believe to be caused by one of Heyward's many cooking eccentricities, probably due to his using a tin of tainted sardines for his "sardine fritters" made yesterday (a dish fit for the infernal regions on fast days.) I have given him orders to bring all tins of meat, before being opened, for the doctor's or my inspection as usual before using them, about which necessary precaution there has been a little slackness lately owing to the ship's arrival and our being very busy. Poor Heyward does very well with the cooking on the whole, and his billet of catering for the appetites of six hungry men is no sinecure. He is very plucky and anxious to please.

As neither of us feel particularly in form for coal hauling, I put it off until Monday.

September 6th, Sunday.—The doctor and I are still feeling very cheap. I found the small boat to-day Leigh Smith left on the bank by the flagstaff. The top of the

gunwale is projecting out of the ice of the floe berg, all the rest is buried under and frozen into tons of ice.

I entered up and packed away negatives. The others amused themselves as they pleased.

September 8th, Tuesday.—We set to work after breakfast to fit up a dredge and tow-net, and fix lines to them

DREDGING IN OUR WHALE-BOAT FOR MARINE LIFE

to do some dredging, as the weather to-day allows of it. This took us all the morning. After many delays we set out in the *Mary Harmsworth*, going west along the land. We found the bottom very rocky and unsuitable for dredging, the spring tide (against us) carrying ice with it, bothered us a good deal, and finally blocked us in altogether off the west point. As it was then getting late in the evening and darkness was coming on we hauled the boat up on the shore, and I intend, if the weather allows, to try again to-morrow. She is a fearful weight to handle.

I reluctantly directed the doctor to kill and cut up two out of the three of our remaining sheep, which were brought from Vardo, as we require the hay they are eating for the pony. Being rather dainty feeders they waste a good deal. The ground is now quite snow-covered and frozen hard, and they cannot find their own food, being less clever in this respect than "Brownie," our pony. They have become pets with all of us, and follow us everywhere, poor animals. I am very sorry to have to kill them. "Nannie," the remaining one (an especial favourite of mine), followed us down to the boat to-day and clambered on to the floe-berg when we shoved off, bleating piteously, evidently in great distress at our apparent desertion of her. On our return she met us and followed us into the hut, where she remained all the evening, eating biscuits or anything of the kind we offered to her. Having the sheep here, and seeing them about, quite reminds us of home, and even the delicacy of mutton for dinner, tough Norwegian though it be, does not compensate us for the loss of them, and it goes to my heart to kill them. I shall try and keep "Nannie" all winter.

September 9th, Wednesday.—As soon as we had finished our usual morning walk we set out for the spot where we had left the boat yesterday evening. We found, however, that a quantity of ice had since come into the bay and blocked her in. Armitage, in getting into the boat, went over the side, and got a ducking. He is a wonderful hand at taking a bath whenever the smallest possibility of doing so offers itself. I had of course to send him back to the hut to change, and as he is an excellent man, it left us very short handed. It took us some hours to force our way out of the small bay, and some of the ice-pieces being aground,

we had to cut them up, using the ice-anchor as a pick, to clear a way. At last, however, we got her free, and pulled towards the northern entrance of Windy Gully. Here a frozen-together pack stopped us and prevented our getting near the shore. We dropped the dredge in fifteen fathoms and put out the net and dragged both for some distance, which was rather hard work, and the boat only forged ahead a few inches at every stroke of the oars. We obtained several molluscs, echinoderms, worms, gastropods, and bivalves. We found there the bottom sandy and suitable for dredging, but further round, off the glacier face, it is evidently stony, as we only got a laminaria with a sea cucumber (an echinoderm) attached.

We made a pot of tea on a piece of floating ice in Gunter Sound, and had a little biscuit and fat bacon. We got back to the hut soon after 7 P.M.

September 10th, Thursday.—Directly after breakfast we again started off in the *Mary Harmsworth* dredging. We went east, under sail, along the edge of the land floe, using the tow net. We found that even under sail, with a breeze of force four, we could only move along very slowly, with the dredge out in fifteen fathoms, on a pebbly bottom with shells. We got some crustaciæ, anylid worms, echinoderms, and protozoa. I shot a ringed seal, which, however, sank before we could get up to it, owing to having the dredge out. Poor "Nannie," in following us, fell into an ice-gorge about six feet deep, out of which she could not scramble. The accident was not discovered until the evening, when she was found to be missing. I discovered her in the chasm, and brought her back on the wheelbarrow, as she has damaged her off hind leg a little and is lame.

September 12th, Saturday.—After breakfast, the sky

MR. A. B. ARMITAGE

being less overcast than usual, I took a number of photographs with the wide angle lens. Armitage tried his hand at dentistry by pulling out a troublesome tooth of the doctor's. The doctor is satisfied with the way in which the operation was performed, so he must have acquitted himself exceedingly well.

We then started off in the whale-boat dredging, and I took a number of soundings in the bay. We found patches of sand distributed amongst large stones, and succeeded in obtaining large hauls from the dredge, including new species of anylids, crustaceæ, and molluscs. Bay-ice is now quickly forming on the sea. Apparently all the birds but one or two kittiwakes, a burgie or two, and a stray mollymoke, are gone, and the rocks are silent and deserted, where recently there was so much life and bird music. We shall soon be left alone in our winter solitude.

Winds N.N.W. and N.W. 1 to 3. Sky clouded $\frac{1}{10}$ ths. Rainband o.o.

September 13th, Sunday. — We amused ourselves skating on the pond to-day. Towards evening I came in and developed negatives.

September 14th, Monday. — After breakfast we all went down and hauled up the *Mary Harmsworth*, and put her to bed for the winter.

The sea is now covered with bay ice, and further dredging is out of the question in her.

September 17th, Thursday. — After breakfast, having finished our regular morning work, Armitage, Wilton, Heyward and I went on hauling reindeer moss up the slope. The doctor removed the blubber from the seal's skin. We are keeping it to cook with bear meat. I induced one or two of the others to try some raw seal blubber. It is very good, and tastes somewhat like butter.

The reindeer still looks very thin, and does not

improve in condition, although it has as much lichen as it will eat. It is very wasteful and dainty, and tramples under foot and refuses to eat as much as it consumes. One hardy "eat-all" pony or horse is better than fifty reindeer away from their natural conditions of life.

September 18th, Friday.—As to-day is very suitable for magnetic observations, I directed Armitage to go on with them. The doctor worked at the bearskins in No. 2 hut. I made a number of prints from negatives, and printed and developed some "platino-bromide" prints, and made a number of solutions for toning, fixing, &c. Photography is carried on under difficult conditions here, and even after a negative has been successfully obtained, every drop of water used in developing and washing has to be obtained from melted snow.

September 24th, Thursday.—In the evening Wilton and I made a broad snow shovel for five people, to clear the snow off our skating pond, as there has been no wind lately to do this for us. Armitage wrote up the meteorological observations. Wilton and Heyward stowed away goods in the stable-store. The doctor went on with the bearskins.

September 27th, Sunday.—We took the tow-net to the floe-edge, and obtained a new shrimp, a number of star fish, and a few small jelly fish.

The doctor is making a sketch map of Cape Flora, and he went out with Armitage, who took a few bearings for him.

October 2nd, Friday.—After breakfast I put out my photographic printing frames, but the frozen mist renders printing a very difficult matter. It takes two, and sometimes three, days now to finish a print.

I set to work to try and repair the musical-box which

KITTIWAKES NESTING ON THE ROCKS OF CAPE FLORA

“our mechanical genius” had so damaged in putting in a set of new notes that the only sounds that can be got out of it are positively unearthly, and half the notes won’t strike at all. The “music” resulting is most weird.

Armitage is making a collar for the pony harness. He is utilising the canvas saddle we made last autumn for material to cover it, and is using two of the Union Jack cushions to stuff it with.

We set a line between the shore and a piece of grounded ice for fish, and put out a swab to take smaller life. The doctor worked at the bearskins.

I saw two ivory gulls and three buntings to-day.

October 9th, Friday.—As I wish to try the reindeer for sledging the coal up to the hut, after breakfast I made a hide halter, and Wilton and I put it in a sledge. I find it has evidently never been harnessed to anything before—has no notion of dragging—and is, moreover, very vicious, and strikes and kicks at every one and every thing that comes within reach of him. A charming animal! It made a desperate charge at Wilton, who was seated on the sledge, who was rolled over in a mixed up condition into the snow, where the fiendish deer seemed to lose him; it then dashed off wildly in an opposite direction, dragging the sledge upside down with it until I succeeded in stopping it. Wilton has reluctantly come to the conclusion that it is not at all a nice animal. I certainly cannot warrant it “quiet to ride and drive.” It is a thousand pities that any reindeer were sent, as they would be of very little service here even if well trained and broken; but young, quite unbroken animals are worse than useless. It kicked, struck, danced about, and flung itself down when asked to draw a weight of 160 lbs. on a light Norwegian sledge!

October 10th, Saturday.—Armitage spent the day in

the observatory at the magnetic observations. Wilton continued clearing the dog-house of ice, with Heyward helping for a time.

Winds N.E. 4, E. 2 to 3, S.E. 1, N.E. 2, with gusts up to force 5.

“Gladys” gave birth to five pups.

October 13th, Tuesday.—As “Nannie,” our sheep, wastes so much hay, which, excepting biscuit, is the only thing she will eat, and as I want every scrap of the former for “Brownie,” the pony, I very reluctantly told the doctor to convert her into mutton, for there is no help for it. Poor animal! She had become a great pet with us. I feel very sorry to be obliged to kill her, and it is like losing a friend. I sledged a number of stores up, and placed them in the stable store. After tea the doctor and I sledged away the ice Wilton and Heyward had cleared out of the dog-house.

October 17th, Saturday.—The Arctic night began to-day, and we saw the last of the sun yesterday until February 23rd. Again another winter is upon us—now the third here, and the fourth I have spent in succession inside the Polar circle. No one properly appreciates light until they have spent a winter or two on the 80th degree, and know what it is to be in perpetual darkness for four months at a stretch.

I caulked the crevices in the walls of the stable-store, to prevent snow from driving in, and swept it out. Armitage took the usual weekly magnetic observations. Wilton went on with the dog-house. The doctor worked at the geological specimens.

October 18th, Sunday.—After breakfast we all went east on our ski. Wilton and I again went to the top of the glacier by the Windy Gully Rocks and ran down it three or four times. The others did not care about taking it on, but remained near Sharpe’s Rock, where

the incline is less, and a slower speed can be maintained. Wilton goes very well upon the ski, having used them at Archangel.

October 20th, Tuesday.—A flock of birds were seen in the sea off the flagstaff. Thinking that probably they would be in their winter dress, the distance being too far to make them out, and the light too dim, I called Wilton and we carried the twelve-foot Norwegian boat down, and, taking my gun, we managed to force it through the bay-ice into shooting distance. We found they were dovebies, eleven in number, in their winter plumage. I succeeded in bagging two—one adult in winter dress, and a young one in winter dress also, with the legs nearly as red as in the adult, but with a tinge of brown in them still. The young bird I killed in August 1895 had quite brown legs.

We all then went for a ski-run to the eastward, and Wilton and I ran the glacier two or three times. There is distinct evidence of this glacier having receded considerably. To the northward, partly extending across Windy Gully is a high, large mound of earth and stones, evidently an old lateral moraine, and at the foot of the gully leading up towards Windy Gully Rocks are large boulders of basalt worn quite flat and scratched evidently by ice, over which the glacier then passed. Evidence of the recession of glaciers is noticeable on Capes Grant and Neale, where old moraines are visible.

October 21st, Wednesday.—The doctor and I sledged coal up with the pony from the top of the plateau up which we had hauled it, and after tea he, Wilton, and I went for a ski-run east. The others had gone earlier in the afternoon. It had snowed all night and the greater part of the day without wind, and there is now a good covering of snow over the land. "Brownie" is

still getting the greater part of her food herself. She scrapes away the snow with her forefeet to reach the sparse grass, and is as good as a reindeer at it. She has only two or three Spratt's cod-liver-oil dog-biscuits given to her daily, which she occasionally supplements by stealing more from the dogs tied up round the boulders near the house, much to their indignation and her amusement. She is thoroughly adapted for the Arctic. She eats bear-meat but draws the line at walrus, with which taste I sympathise, for I do so also if I can get any other fresh meat. None of us care for walrus.

October 22nd, Thursday.—To give my chaps a little amusement I arranged that a match between Wilton on foot and the doctor on ski should be run to-day down the glacier slope from the Windy Gully Rocks, and I put up a tin of tobacco as a prize for the winner. While waiting for one or two members of the party, Wilton and I put the twelve-foot Norwegian boat into the sea for me to try and shoot some seals I had seen in the water. Soon afterwards I saw some dovebies in their winter plumage, and we pulled back for me to land and fetch a shot-gun to kill them for specimens. In stepping out on to the ice-foot it broke away with me, and the small boat at the same time dipping bows under and upsetting, threw me into the water. I got hold of the ice-foot and tried to pull myself up, but was quite unable to do so owing to its perpendicular height above me—about four feet—and its slippery surface sloping downwards gave me no hand-hold my clothes had also become exceedingly heavy. Wilton in the meantime had very promptly thrown my .303 rifle on to the ice-foot out of the water-logged boat, which had partly righted itself on being relieved of my weight, but was sinking, and after several minutes he succeeded in getting ashore off the

keel of the overturned boat. I had made up my mind to swim back to it, as I found it quite impossible to get up the ice-face, and my strength was going. He then ran round to where I was, and after several attempts and much hauling and struggling, managed to give me a hand out. I had been in the water about five minutes. The cold did not bother me much, but the weight of my heavy clothing drenched with water did, and the tide was running fast under the ice. It would have been an easy matter for both of us to have been drowned, and no one would have known what had happened to us. Fortunately Wilton had the boat to help him out, otherwise we should have had to swim back to it, and have tried to push her to some low bay-ice, and to clamber out upon it if our strength had held out, but it would not have been altogether a joke. We had a good laugh over it when we got out, but it was near not being a laughing matter. We went up and changed, and I sent Armitage and the others down to put the small *Eira* boat into the sea to recover our cranky Norwegian one, and to shoot the dovebies. We then went off to the Windy Gully Rocks, where the race came off, and Wilton won easily. The snow was deep and "sandy," making it very bad for ski-ing, otherwise the result should have been reversed.

October 27th, Tuesday.—After breakfast Wilton reported to me that the reindeer seems very weak and can hardly stand. I went and saw it, and found it again lying down. I had intended to put a log on it and turn it out on the cape, hoping that the comparative freedom might enable it to put a little flesh upon its body, but it would have to take its chance of being killed by a bear, which would in all probability happen. I however decided to shoot it, "to save its life" and add what

little meat there is on it to our larder, as I could see it would die within a short time. I would never have attempted the experiment with any deer that had not been brought up from fawns upon artificial food, which can be carried sledging, and had been thoroughly broken to sledge work and used to confinement. But even then I doubt very much if they would be the best form of draught animals out of their own kind of country, where their natural lichen grows everywhere. For coast sledging here horses are far and away the best. I had much experience with reindeer when sledging with the Samoyads and Lapps in the winter of 1893-94.

I put three thermometers in pickle bottles, and placed them in the screen to compare with the others. I am anxious to take temperatures upon the summit of Cape Flora through the winter, but I find it very difficult to hit upon a plan for exposing them in a satisfactory manner to give accurate readings. I think placing them in pickle bottles lashed to an upright may do it. Tins, screens, or boxes of any kind, all have fatal objections. The frost-rime at that altitude is exceedingly troublesome.

October 28th, Wednesday.—The doctor and I dug out of the drift and sledged up to the stable the whole of the hay sent for the sheep. After tea, he, Wilton, and I hoisted it on to the roof of the stable (there are, in all, seven and a half trusses.) It is, however, like the reindeer moss, drenched with water, and consequently exceedingly heavy, and until dried, which it is difficult to do here, quite useless for sledging on account of its weight. I shall never take hay for that purpose again unless absolutely obliged; it is too wasteful and bulky, and readily becomes driven full of snow on the sledge, which adds very greatly to the weight. Oats and dried

vegetables in proper proportions make splendid food, and are very convenient to carry and use. We are, unfortunately, out of both, with the exception of a little I am keeping for sledging next spring, and I am feeding the pony on hay and Spratt's biscuit.

Wilton and Heyward worked at the dog-house.

Winds E.N.E. 4, N.E. 3 to 4, E. 1 to 2, E. 2 to 3, sky clouded from $\frac{8}{10}$ ths to $\frac{10}{10}$ ths until 8 p.m. when it cleared to $\frac{2}{10}$ ths. Misty at 4 P.M.

I find the minimum thermometer placed in the pickle bottle registered the same as our standard minimum for the last twenty-four hours.

"Brownie" frequently steals bear's meat from the dogs, and daily eats about two pounds of it. She is a wonderful feeder, and just the "gee" for the Arctic. Thank goodness she is not particular. She has become a great favourite, and follows us about like a dog. I've a real affection for the good little beast, and look forward to giving her a good time for the rest of her life after we have finished our work here, if I can only keep her alive to return home.

October 29th, Thursday.—We dug out and brought up the bear's meat from near Sharpe's Rock which had been stowed there some weeks ago. Wilton and Heyward finished stocking the ice out of the dog-house.

Wind E. by N. 1, N.E. by N. 3, N.E. 1 to 2, N. by E. 2. Sky clouded all day from $\frac{8}{10}$ ths to $\frac{10}{10}$ ths, except at 4 P.M. when it cleared to $\frac{4}{10}$ ths.

To-day I find that the thermometers enclosed in bottles show uneven readings when compared with the standard thermometers in the screen. I think that to carry on synchronous observations at the hut and on the summit of Cape Flora would have little value under the circumstances. I shall, however, place a maximum and minimum in bottles on the top and read them when

convenient. It will give us a good idea of the highest and lowest temperatures up there.

October 30th, Friday.—The doctor and I ascended Cape Flora by the glacier, and placed a maximum and minimum thermometer in a bottle on the top of the cairn on the edge of the cliffs behind the hut. (Temperature, on summit -6° and -2.5° at the hut.) The cairn (the flagstaff had been blown away) and everything on the top was covered many inches deep with frost-rime. The edge of the summit is very precipitous, and being ice-clad is rather dangerous in the dim light, and one has to feel one's way along with caution: a false step might send one crashing down the front of the cape a thousand feet below. I set Armitage to work to begin to make a canoe to carry sledging next spring, and he commenced the framework, using the bamboo boat masts and booms for the purpose.

The twilight at noon is getting very dim, and winter is rapidly drawing its dark, gloomy mantle around us. The birds have all flown to the South, and deathlike stillness now reigns on the rocks where their cheering notes have been as music to our ears through the short-lived and comparatively winterly summer of this land of the North, where the ghostly Frost-King allows Old Sol to dispute his sovereignty for a short time only. Perpetual darkness will be ours for four months to come, and for that time we shall not know the cheering light of day. It is with a feeling of sadness that we see his rays grow daily weaker and weaker, like a dying friend, and at last he sinks, to appear no more. Each of us wonders if we all shall stand near the flagstaff to welcome his return, or will some of us, during that long darkness, have gone forth into the gloom, and have found our rest upon these icy shores.

November 3rd, Tuesday.—The doctor and I finished sledging up and stacking the coal, and also brought the ten bags of salt up. After tea, I worked at the framework for the new canoe, and the doctor cleaned a bear's head, to be stowed away with the skins. Armitage helped me with the canoe and then went out on his

OUR COAL SACKS
(By moonlight.)

ski to the eastward for the usual exercise. Wilton and Heyward began to roof in the dog-house. "Bardock" died during the night from no apparent cause. He was all right yesterday. He was of little use for sledging however.

November 4th, Wednesday.—As I think it is possible to get foxes by means of a spring gun, and every other means has failed, I set to work to convert a shot gun into one, lashing a contrivance of wooden levers to it for the purpose,

About 3 p.m. Wilton and I went east for a run on

ski, returning over the floe. The doctor finished a bear's head. Armitage worked at the framework of the canoe. Wilton and Heyward went on roofing in the dog-house. All hands go for a run on ski, or for a walk every day. This has been the rule ever since we landed here.

November 10th, Tuesday.—The doctor and I went on ski to the Gully Rocks to look at my spring gun which I set there, but found everything untouched. It is now practically dark all day, and we are beginning to speak with longing for the return of the sun. Still, the dim twilight we get now for an hour or two is infinitely better than the greater darkness which we shall soon have when, practically, noon and midnight are alike. People who have wintered only on the 70° N. or 75° N. are possibly unable to appreciate the greater darkness on the 80° of latitude or understand what a difference five or ten degrees make. Life is the acme of monotony during the winter here. It is bad enough during the light; it becomes worse as time goes on. A more trying life than that of prolonged residence in the Arctic it is difficult to imagine. It is wearisome in the extreme. People generally have an idea that it is the cold and badness of the climate that are the most unpleasant features about it. Not a bit of it. To me it is the deadly monotony of our daily life, the long period of comparative inaction that is unavoidable, and the deadly sameness which one is unable to get away from for an instant, being boxed up with the same companions day after day, month after month. It is a life, however, to imbue patience and forbearance in all, and should do one good in that respect.

Wilton went on with the dog-house. Armitage worked at the canoe. The doctor packed up and

labelled geological specimens. And each and all are cheerful and jolly, in spite of the monotony of our existence, and of depression there is no sign. I have thorough good fellows with me, and of this I am proud.

November 12th, Thursday.—This morning Wilton and I went for a walk east upon ski. It was dark and very misty, so much so that we got upon the top of a sloping berg, with the one edge towards us level with the floe and the other ending in a drop of from six to nine feet, over which Wilton fell without seeing it, but without hurting himself, fortunately. When near Sharpe's Rock "Misere" spotted a bear (the first seen for a long time), about fifty yards off, which had apparently been stalking us. We left him to take care of "Mr. Bear" and returned to the hut for rifles. Unfortunately he left him, and on our return with "Nimrod" they were unable to get on his track, owing to the mist and darkness. "Nimrod" is now our only bear dog; the rest are not worth much for hunting. The pups when older no doubt will take to it, as they even now exhibit very distinctly sporting instincts.

November 14th, Saturday.—The doctor, Wilton, and I went for a run on ski on the floe west at midday as far as the glacier. Armitage has been engaged at the weekly series of magnetic observations all day; the others at their regular work.

Winds N.E. 6, N.E. 3 to 4, E.N.E. 1 to 2, N.E. 1. Sky clouded $\frac{2}{10}$ ths to $\frac{1}{8}$ ths.

The doctor had quite a field day to-day as I got him to snip off "Joey's" dew-claws, as breaking through the surface of the snow makes him go lame. This should have been done when he was a puppy. He is a little under-sized Lapp dog which arrived by the *Windward* in addition to the reindeer for draught purposes.

November 16th, Monday.—I see in a June number of a newspaper of 1895 an announcement and description of the discovery of photography in colours which appears to be entirely successful and very simple. I wish a few ruled glass screens had been sent to me this summer. Photographs in colour would add immensely to the value of the Expedition in so many ways, and the colourings on the rocks here of bright reds, greens, and dark browns are very beautiful, as also are the brilliant purples, greens and golds of the mosses upon the plateau, I hope some one may think of it next year.

I tried to photograph the aurora this evening, but after waiting outside with the camera for two hours I had to give up the attempt for the night, as it proved too transient for there to be a chance of success. I feel sure a very long exposure is necessary.

“Brownie” appears to be doing very well on her miscellaneous diet. In addition to her regular feed of Spratt’s dog-biscuit, ship-biscuit and hay, she shares the scraps left from our meals with the dogs, and very frequently helps herself to their bear’s-meat, and shows a fondness for picking loom-skins lying around the hut. She is a wonderful animal! I let her run around the hut when the weather is good, and she often trots off east and finds a meal for herself on grass from which she scrapes the snow with her feet. I try, however, to prevent her going far away now that it is dark all day, as I am afraid of a bear sneaking up to her and killing her.

We are again beginning to be bothered with sleeplessness as in previous winters. The doctor can offer no explanation as to the exact condition of body or mind that the darkness produces and which causes it.

November 17th, Tuesday.—By dint of constant super-

vision, on the part of the doctor and myself, we are able to turn out decent bread: until recently it has been horrible stuff. To make the yeast we find the following recipe answer well:

Take two handfuls of hops to which add a quart of water and boil for half an hour. Pour off the liquor to which add a table-spoonful of flour and a dessert-spoonful of sugar. Place it in an uncorked bottle and hang it up in a warm temperature for twenty-four hours, shaking it occasionally. Take five ounces for ten pounds of bread.

On taking away the five ounces of fermented liquor replace them with five ounces of warm water and a dessert-spoonful of flour: some add a further dessert-spoonful of sugar also, but it appears to be hardly necessary.

Well knead the dough, then allow it to stand in a warm place for twenty-four hours; then well knead again, pressing in as much flour as the dough will take, allow it to stand for an hour or so until it has risen again, and then bake it in a covered tin. A fresh lot of yeast should be made once a month, as it is liable to become sour.

About 6 P.M. I took the cameras on to the floe to get moonlight photos of the "big berg," and fetched them in at midnight.

Winds N. 4, S.W. 2, S.W. 1. Sky clouded $\frac{2}{10}$ ths to $\frac{4}{10}$ ths.

November 19th, Thursday.—The moon being bright, sky clear, and very little wind, I took out the half plate and hand cameras to the floe, and set them for time exposures on the berg and for a panoramic picture of the coast lines here. I went backwards and forwards from them to the hut at intervals of a little over an hour until after midnight, and I reckon that I have walked over nine miles to-day in doing this. Wilton and I

measured the berg with a tape measure, finding the height to be sixty-one feet, and at the base measured 456 feet round. This is nearly as high as any berg I have seen in Franz Josef Land.

November 23rd, Monday.—The doctor and I noticed to-day, when out east, that the tide has forced its way through some cracks at the head of the bay, and on stirring up the mixture of snow and salt water with my ski stick, we noticed bright phosphorescent bodies in it shining like glow-worms. We collected a number of these, and found them to be Crustaciæ(not before obtained here) about the size of a grain of rice.

As "Misere" is showing indications of a desire to eat "Mr. Råwing, jun.," I constructed a muzzle for him to-day, which he now wears. He doesn't like it a bit, and looks very absurd, but his murderous propensities must be checked.

November 25th, Wednesday.—I again tried to photograph the room, using the rapid rectilinear lens F. 8, landscape films, and one hour's exposure. These came out much better. I think, perhaps, my previous failures may be owing to the developer I have used. To-day I changed it for amidol. I then went for a little exercise on my ski on the floe, but it was blowing so hard, with such dense driving snow and thick mist, that it was impossible to find a way at all or to keep the land in view, and I had to return to the plateau by the hut. Armitage and I worked at the canoe after tea. The doctor packed up geological specimens.

November 26th, Thursday.—To-day I tried the wide-angle lens on our general room, giving two hours' exposure with a landscape film. The doctor and I then went for a walk on the floe, I using my ski. It was, however, very dark and misty, making it difficult to find one's way.

Open water runs for some distance up Gunter Sound. After tea I developed the negative of the room, which is more successful.

December 1st, Tuesday.—As the aurora was bright and the weather calm and clear, I made five photographic exposures with rapid plates, using the rectilinear lens and a stop F. 8. On one plate only did I get a faint impression, and that was of a single streamer, which remained fixed for a considerable period, and then appeared and reappeared in the same spot several times.* I believe the aurora has never been photographed. I then made a few bromide prints from the negatives I have recently taken.

Armitage took an observation for time. The doctor worked at the geological specimens.

Winds calm, N.W. 0 to 1, N. 1. Sky clouded $\frac{1}{10}$ th to $\frac{6}{10}$ ths.

December 4th, Friday.—I took out the camera and set it for two hours for the aurora. Although I got a slight impression of part of the rocks of Cape Gertrude and Cape Flora, no trace of the aurora could be found on the negative. Its rays evidently have small photographic value. There was no moon, but only starlight.

I have been doing my utmost to increase the number and quality of our dogs by breeding, as they have decreased in number to an alarming extent, and our team will soon be reduced to puppies born here, of which my two little Samoyad bitches, "Sally" and "Jinnie," were the mothers or grandmothers.

December 5th, Saturday.—Set the camera to take the south-east side of the living room, giving four and a quarter hours' exposure. The doctor and I went for a ski run to the top of the east glacier. All the tinned

* This was the only impression of the aurora I ever obtained, although I tried on a great many occasions.

vegetables have been used. Two hundred pounds of tinned vegetable came by the *Windward*. Two pounds (one tin) makes a small allowance for six people per day. We have some dried potatoes, some haricot beans, and about half a peck of dried peas. The dried vegetables, which I have been keeping for "Brownie" for spring sledging, I shall not have touched, but shall reserve them for that purpose.

Armitage took the usual weekly set of magnetic observations. The doctor finished labelling and packing the geological specimens. I developed negatives and made transparencies.

Calm all day. Sky clouded $\frac{1}{10}$ ths to $\frac{1}{8}$ ths. Misty at 8 P.M.

December 10th, Thursday.—As the new moon was just appearing above the southern horizon, I took the camera out beyond the hut and exposed a negative upon it for a second and then closed the dark-slide until after the moon had set, as the movement of it across the negative would have produced only a streak if exposed longer. I then opened the dark slide to get the landscape, giving five and three quarter hours' exposure with F. 8, and a rapid plate. I thus got a natural moon in my photograph.

Winds N.E. 3, N.E. 4. Calm, calm. Sky cloudless all day. A good deal of aurora.

December 14th, Thursday.—I am making a tent of my own design, using some old light canvas sledge-covers I had on my Waigatz Expedition. The doctor has made a good suggestion for an entrance, and I think it will be a model tent for the Arctic. It will be very light—not exceeding, I think, twenty pounds in weight—and can be expeditiously put up. Armitage went on with the canoe. The doctor began to make a photographic album for me

to put my prints in from some sealskin I have. He is very clever and neat with his fingers, and everything he does he does well.

Things have been going very smoothly and pleasantly; there has not been a sign of quarrelling or unkind speaking, and every one is happy and well. Heyward has shown marked signs of improvement in his cooking and in every way. I praise his endeavours and encourage him to persevere.

December 15th, Tuesday.—I went on sewing the tent. Armitage worked at the canoe. The doctor made progress with my photographic album.

I let "Brownie" run about outside the stable most of the day now. She takes a short stroll down east to try and dig out the grass, but there is now too much hard snow for her to find it. We have fourteen pups in the stable (four of Gladys's, four of Daisy's and six of Madame Kara's).

Winds N.N.W. 2, N. by W. 2, N.W. by W. 1 to 2. Sky clouded $\frac{2}{10}$ ths to $\frac{1}{10}$ ths. Nine hours snow. Foggy all day.

December 16th, Wednesday.—Armitage worked out the observation for latitudes taken on the 11th from two stars, making the latitude from both $79^{\circ} 56' 06''$ N., both agreeing exactly into a decimal or two, but this puts the latitude of the hut a trifle further south of previous observations.

December 17th, Thursday.—As the morning was fine and clear, with the moon three-quarters full, I arranged a ski run. Wilton and I went east, and I examined the spring-gun, as the moonlight is now light enough to find it without the risk of getting foul of the lines by accident and so shooting oneself. I found both barrels discharged and the two baits taken. There was so much snow covering the ice that I could not be sure if any dead

foxes are lying near, but I have a shrewd suspicion that they have contrived to fire the gun and take the baits without harm to themselves. Wilton and I then went up Windy Gully, running the glacier several times, and met the others on the floe in Gunter Sound. It is remarkable how a fine pleasant day (although it is night) makes every one so especially cheerful and happy. Light has a wonderful effect upon human beings.

I did some photography on getting back to the hut, but the sky soon misted over and stopped me.

Winds W. 4, N.W. 4, N.W. 3 to 4, W. 4. Sky clouded $\frac{1}{10}$ th to $\frac{1}{8}$ ths. Snowing and misty at 8 A.M. Lunar halo at 8 P.M. and sky clouded, moving over rapidly from the north.

December 19th, Saturday.—I am having loom meat fried every day for us to take sledging. It will save fuel, time, and weight when on the journey. I find by weighing it that a pound and three-quarters before being cooked loses half a pound in frying, weighing a pound and a quarter after, even with the addition of fat. It is a great economy thus to get rid of water and save weight.

"Jack," "Sally's" son, died yesterday morning without any apparent cause. I wish I had some bears' meat to give the dogs, for a little change of food is useful. The dog biscuit is excellent and they have been living upon it for many weeks. Bears have been very scarce for a long time.

December 20th, Sunday.—The day being clear and moonlight, but with a good deal of wind, I went east with young Heyward, and we got a fine ski run from the top of the glacier behind Cape Flora into Windy Gully. He is a plucky fellow, and goes well on ski. I noticed the tracks of a bear following for a long way down some of my old ski marks beyond the Castle Rock, evidently

during the recent very dark, misty weather. The others all went for a ski run towards Cape Gertrude.

Soon after my return I found to my surprise that the ice to the south-west was breaking up, probably caused by the spring tides, a swell from the south-west, and the high wind, and that there was open water running from "Bear Berg" to the large berg which I had used for my photography, and away towards Miers Channel, leaving only a tongue of ice connecting the large berg a mile off the land with the land floe. I had left the stand of my camera upon the berg on Friday, when doing my photographing there, and was stopped by the weather from finishing, in order to have it in exactly the same position when I may be able to resume my panoramic view. As I expected this tongue of ice to break up, I started off to the berg to rescue the stand, leaving Armitage on the look out on shore to launch the twelve-foot Norwegian boat in case I got adrift upon the ice, although I think there would be little chance of his being able to give me any help if this happened. As I approached the berg another large piece of the floe broke off, and was rapidly driven away before the wind and tide into the darkness. After a rapid run on my ski I secured it and was very glad to find myself with the camera-stand safe on Cape Flora again, for I anything but relished my trip to the berg, but I had no desire to lose my stand. The bitterly cold gale was still blowing fiercely, driving fine shotty snow before it, which cut one's face like hail, and the low temperature was very productive of frost bites and general discomfort.

December 21st, Monday.—The shortest day, thank goodness! I am a devout sun-worshipper. Now the light will be returning to us, the gloom of night in a few weeks will lessen, and we can take our daily walks

without stumbling over obstacles at every step. Our explorations can be resumed, and the long nine months of comparative inaction, so hard to endure, will be brought to an end.

When I went out of the hut after breakfast I found to my consternation that the reindeer-house had been carried away by the gale, and all the sledges and most of the sledging gear had disappeared. I called out all the party to try and recover them, and after searching on the floe for some hours, we managed to find all the sledges, and, much to my surprise, so far as I can see in the dark, they are uninjured. The reindeer-house is reduced to matchwood, and only very small portions of it can be found scattered over the ice. We placed the sledges in a sheltered spot at the edge of the floe until the wind abates, as it was then blowing a fresh gale with fierce gusts of force 10 every moment, driving fiercely before it hard, shotty snow, which cut our faces like a whip, so carrying them up the steep slope in the teeth of it was out of the question. We found it difficult to stand upright against the wind, which with a temperature of -16° below zero was a little cool.

This sort of weather continued until evening, when the storm suddenly ceased, the wind fell to a light breeze, and bright moonlight shone out. I seized this opportunity to complete my panoramic views, and taking the camera out to the berg, I set it up again, and took three negatives, which now completes the series. The ice has still further broken up near the berg, and I felt a little uncomfortable while I was out there lest it should continue this process of disruption while I was on it, owing to the fast running spring tides, and the swell the wind has set up.

I ski-ed six miles backwards and forwards to change

the dark slides at the end of each hour, and did not finish until after 2 A.M. After all my pains and some risks run, I hope I shall get satisfactory results.

This afternoon Wilton and I went on with the tent; Armitage worked at the canoe, the doctor at my photographic book. I have asked Bruce to get a drag-net ready for to-morrow, as I think unless the bay ice forms too rapidly we can use it now along the newly broken floe edge, which is firm right up to the water. I am anxious to obtain marine life through the winter. He is making a new net to-night.

Winds N. 8 (and gusts of force 10 every moment. The aneroids were pumping $\frac{5}{100}$ ths in the gusts), N. 7 (gusts force 9), N.W. 2 to 3. Sky clouded $\frac{2}{10}$ ths to $\frac{7}{10}$ ths.

I will here endeavour to describe an ordinary winter day's work, though—paradoxical but true—a great number of days in the Arctic are nights. About 8 A.M. we turn out of our blankets and all have a good wash, and the man whose turn it is has a bath (one man has a bath each morning; the scarcity of water will not admit of more than this). Breakfast then follows, consisting of porridge, tinned fish, fried bear-meat, and tea or coffee. The work of the day then begins. The house is swept out (a duty usually performed by myself during the last twelve months), the breakfast things washed up, and other domestic duties performed. The dogs and pony too have to be fed, the stable and dog-house cleaned out, and the animals exercised.

All then go the regular daily walk. This, unless there is a moon, is taken round and round a circle on the floe marked with small flags, where we stumble over the rough, hummocky ice through the mist and driving snow two or three hours each day.

This rather treadmill-like exercise being completed,

we all return to the hut, where we set to work upon the duties in hand—making tents, dog-harness, pony's snow-boots, weighing out provisions for sledging, and making ration-bags, &c.

In addition, our scientific observations are taken regularly. Throughout the first two winters meteorological observations were carried on two-hourly throughout the night and day, the party being divided into watches for the purpose.

The scene outside the hut is desolate and dreary in the extreme. To the north, behind it, the high basaltic cliffs with the steep talus running down are dimly discernible through the dense mist and falling snow. An occasional gust of wind still comes rushing along at irregular intervals—the expiring remains of a recent gale—and carrying a whirl of icy particles with it. All around elsewhere is an indefinite white expanse, from which here and there project ice-covered boulders. The wind still moans in the cliffs above us. A short distance off the land the roars of ice-pressure proclaim the commotion there existing, now rumbling like distant thunder, now breaking forth into screams and howls suggesting a thousand devils in torture, and then dying out in a shrill whistle like a railway train rushing into a station. For a few moments all is still, and then those weird sounds continue. With loud booms as of distant heavy guns and a medley of yells and shrieks, ice-blocks can be seen piling themselves up in long lines as far as the eye can reach in the gloom of night.

Once a month we get the eagerly looked-for moon, which, if the sky is clear and the weather is calm, entirely alters the aspect of the landscape. Then the fantastically irregular surface of the great ice-floes, the frost-covered cliffs, and the slopes of the eternal glaciers silently and

“THE SCENE OUTSIDE THE HUT IS DESOLATE AND DREARY IN THE EXTREME”

slowly flowing to the sea, are lighted up with a silvery brightness, and all is still and peaceful. Everything in life appears more cheery. Long runs on ski are taken, and should a bear make his appearance and a chase ensue, the day is a red-letter one indeed. Unfortunately such days in Franz Josef Land are of rare occurrence, and the more dreary weather which I have tried to describe is characteristic of the winter in this country.

At about 3 P.M. we knock off work for a few minutes, and have a little tea, bread or ship-biscuit and butter, and then resume our work until 7.30 P.M., when it ceases for the day and we have dinner, consisting of dried soups, bear-meat, and pudding; after which every one follows his own devices—plays cards, smokes, or reads until 11 P.M., when we turn in for the night. Liquor we never touched during the day or when hard work was to be performed. Liquor is worse than useless when physical endurance is required, tea is infinitely better, and is a satisfactory stimulant. During the first two years we had a nip each of port or whisky on Saturday and Sunday nights, and during the third year of our stay, when we were better supplied, on most evenings. Liquor is of no physical service, but morally, in the strict moderation in which we used it, its effect is good. It changes what would otherwise be a dull, monotonous evening into a more or less jolly one. Men like a nip to smoke and yarn over. It does good and not harm in this way. I never had the smallest trouble connected with liquor. It always stood on our rough, home-made "sideboard," but no one thought of touching it without an invitation from me, even when it had become customary to have it each evening, and occasionally I forgot to offer it. Further evidence of what good fellows I had the honour to command. I certainly think our greatest enemies are perpetual darkness and

want of companionship. For six men to be boxed up for years in a hut 20 ft. long by 20 ft. wide—the actual living space of which is about half that—never seeing any other being nor hearing a scrap of news, is a trying existence, yet I can unhesitatingly say no jollier or happier little party ever lived in Northern latitudes. Four months of solid night every year has, however, a depressing effect, not only on the spirits but on the appetite, and it also destroys sleep. Morning, noon and night become unrecognisable, merged into one endless gloom, and but for the welcome advent of the moon once a month, when the sky is sufficiently clear for us to enjoy her rays, we live in a blackness the dreariness of which is indescribable.

As the Englishman in distant climes counts the days to the arrival of his home mail, so we count the hours till the return of the sun, and even as the first rays become visible our spirits rise, and existence altogether wears a different complexion. Then exercise becomes enjoyable, instead of that dreary daily trudge round a given circle in the dark: with the return of the light we feel new life and energy. And yet the climate of Franz Josef Land, even in spring, would not suit all tastes, and is anything but springlike in character. Driving snow, wind, and bitter cold are general; for, be it understood, in all these years the thermometer has never risen higher than eleven degrees above freezing-point, and seventy to eighty degrees below that point is quite common.

They say eels get used to skinning—well, we may have fairly got used to wind, mist, snow and bitter cold—but we hardly like it!

December 23rd, Wednesday.—This morning we discovered that the funnel and cowl to the hut stove had

"THEN THE FANTASTICALLY IRREGULAR SURFACE OF THE GREAT ICE-FLOES, THE FROST-COVERED CLIFFS,
AND THE SLOPES OF THE ETERNAL GLACIERS, SILENTLY AND SLOWLY FLOWING TO THE SEA, ARE
LIGHTED UP WITH A SILVERY BRIGHTNESS AND ALL IS STILL AND PEACEFUL."

(Cape Flare from the fleet by moonlight.)

been carried away in the night by the wind, and that the stove would not burn without smoking abominably; so we had to let it out until Armitage and I had hunted up some old piping and had fixed it up. Wilton and I then searched with lanterns over the floe for articles carried away, and collected portions of the reindeer-house at the foot of the slope. My "soveik" was found on the floe, but the fur breeches had got separated from the bundle in which they were tied, and although he and I looked for hours we could not find them. It has been blowing a moderate wind ranging N. by W. to S.S.E. with gusts up to force 8 all day.

This evening, it being our doctor's thirty-sixth birthday, we had a little festivity in the way of rum punch and a few of my remaining cigars to celebrate it. I had arranged with Armitage that he and I should sit up to 4 A.M. to take an observation for longitude (absolute) by moon-culminating stars, which came on then, as the weather was clear and the wind gave signs of abating. I also took out my camera to the berg to take another negative for my panoramic view in place of one which is not entirely satisfactory. Armitage went out with me. I had however hardly set up my camera, when the wind woke up to a gale from north-east with driving snow and obliged me to take it down. As the gale was straight in our teeth when returning to the hut, with a temperature of 26° below zero, we got a good deal frost bitten about our faces. This put an end to the observation for longitude as well as to the photography.

Winds W. by N. 4, E.S.E. 4, S.S.E. 4, N.E. variable, with incessant gusts of force 5 to 8. Sky clouded $\frac{3}{10}$ ths to $\frac{8}{10}$ ths.

December 24th, Thursday (Christmas Eve).—Bruce and I took down the tow-net to the floe-edge. He had

unfortunately left it in fifteen fathoms of water for a few minutes while he went back to the hut to make a swab to let down. In the interval the ice came in with the tide and overran the floe for some yards nearly burying the line to the net. We tried to clear off the ice, but had to leave it until the moon came round in the evening and gave us some light, owing to the unsafeness of the ice around. After dinner we cleared away the ice with a pick and cut a hole through the bay floe, but could only recover the line owing to a quantity of ice having been squeezed underneath the floe as well as on the top of it. I went on with my work at my new tent. Armitage worked at the canoe. The doctor gave Heyward a hand with the Christmas preparations. A wonderful cake is in progress, I believe, the absence of some of the usual ingredients in which, and the presence of others, is a little startling. However, we are not likely to be very critical; and anything bearing the semblance of a cake will be most acceptably received.

After dinner I took the camera out to the berg to get the negative I require. I am doubtful if it is satisfactory owing to the moon becoming clouded over soon afterwards.

Being Christmas Eve we indulged in rum punch and a box of cigars and cigarettes which friends had sent out, and which I had reserved for Christmas. We had quite a jollification, and were very festive.

Winds W. by N. 2, E. by S. 2, E. by S. 3. Sky clouded $\frac{2}{10}$ ths to 0, but late in the evening $\frac{7}{10}$ ths.

December 25th, Friday (Christmas Day).—Another Christmas! Another year drawing to a close; we have done some geographical work; we have added to our map; we have welcomed unexpected guests, and seen them depart to more hospitable regions. Christmas con-

jures up memories of friends and home, remembering former Yuletides ours is a poor attempt at festivity. We

OUR CHRISTMAS DINNER, 1896

have no presents to give or receive, no holly decoration, no beef nor turkey, and the shouts of children's voices round a Christmas-tree are wanting. All the

recognised associations of Christmas are absent. As far as the weather is concerned it has been a thoroughly unpleasant day. It has been blowing from an easterly and east-south-easterly direction from a moderate wind to a fresh gale with snow and mist and a temperature of about 26° below zero.

After taking a little exercise I fitted up a pair of ski with new lashings. The others read and smoked, as we are of course observing to day as a holiday.

As we sat down to dinner at 8 P.M. I took a photograph of the party at table, using up the remainder of the magnesium ribbon I had.

Heyward cooked us a very good dinner—the chief attractions being a haunch of mutton (kept for the occasion), Mrs. Alec. Tweedie's plum-pudding, redolent of Buzzard's, followed by cigars and cigarettes with rum punch afterwards. It was Mrs. Tweedie who speculated upon my meeting with Nansen a couple of years before it took place in a preface to "A Girl's Ride in Iceland." I proposed the following toasts:

"Her Majesty the Queen."

"Mr. and Mrs. Harmsworth, Mr. Montefiore and all our friends."

"Dr. Nansen, Johansen, Sverdrup and the party on the *Fram*."

Armitage proposed my health, to which I responded, and drank to all the members of the party.

Armitage and the doctor sang several songs, Wilton regaled us with one or two of Russian origin and a dance, and Heyward gave us a Spanish one with a remarkable chorus.

We kept it up until 3.30 A.M. and altogether spent a very jolly evening.

Winds E. 4, E. by S. 5, E.S., E.S.E. 7 to 8. Sky clouded $\frac{2}{10}$ ths at 8 A.M., overcast the rest of the day. Snow after 4 p.m. and mist.

December 26th, Saturday.—As some of the dogs have got out of condition and we are out of bear-meat, which I have been using sparingly (we have now fifteen dogs, five bitches and fourteen pups), I am using tinned meat for them, giving those that most need it two pounds a day and the others one pound, with as much Spratt's biscuit as they will eat. It is extravagant feeding them on tinned meat but I must at all costs keep them in good condition for the spring sledging, and these dogs have always been used to an entirely carnivorous diet. The long darkness is very trying to them. I wish a few bears would turn up, as we want meat. We and Nansen together I fear have much thinned them.

I, to-day, made muzzles for the dogs in the worst condition, to prevent their killing each other, and have let them run loose, which will help to improve them.

December 30th, Wednesday.—We are all very busy with preparations for spring sledging, one man is sewing a tent, another making jumpers, a third dog-traces. Our room has quite the appearance of a factory workshop.

The barometer fell to 28.76. Winds E. 2, N.N.E. 4, N.E. 5, E. by S. 5 to 6.

Sky clouded at 8 A.M. $\frac{8}{10}$ ths. Noon $\frac{4}{10}$ ths. Overcast the rest of the day with very dense mist all day and heavy snow after noon.

A swell can be heard this evening breaking upon the floe edge. Thermometer rose to $+15.5^{\circ}$ at 4 P.M.

CHAPTER XXVII

WE PREPARE AGAIN FOR SLEDGING

January 1st, 1897. — We had our usual “festival dinner” in the evening with mutton and fiz, Armitage’s plum-pudding, most kindly sent out by his father, followed by punch and song during the evening, and this ends our Christmas fare. Back we go to bear, monotony and work.

A piece of these much prized sheep is the only civilised meat food we of the old brigade have tasted for nearly three years. The peacocks’ tongues and other delicacies of the Roman Emperor’s board could not have tasted more delicious than did these very tough Norwegian sheep to us, and a glass of Champagne once in twelve months becomes indeed the nectar of the Gods!

January 6th, Wednesday. — A clear fine day with a good deal of glow in the sky to the south about noon. Every one feels in the best of good spirits in fine weather, it bucks every one up.

Wilton and I went for a run on ski to the top of the east glacier, the others went west not relishing the fast run down the glacier in the dark.

Winds S.E. 3, S.E. 4, E.S.E. 3. Sky clouded 0 to $\frac{2}{10}$ ths. The wind was blowing from N.N.E. on the east glacier.

January 8th, Friday. — Blowing from a moderate to a fresh gale from east to south-east-by-east. After noon it became overcast and misty and snow fell.

I took my usual bad weather walk round and round

the pond, and all the others went as usual for the daily constitutional. In darkness and storm it is very like a treadmill this enforced exercise, and all are glad when it is over.

Armitage worked at the canoe. Wilton helped me with the tent. The doctor worked at a woollen jumper I

FRAMEWORK OF CANVAS CANOE (BY MOONLIGHT)

am showing him how to make for sledging. I find that loom meat in frying loses .37.5 per cent. in weight which means that it must have about 50 per cent. of the water driven off, as it takes up fat in cooking, which adds to its weight. I am having meat cooked daily for sledging, then weigh it out, tie it up in ration bags, and place it out of doors to freeze.

Winds E. 7, E. by S. 7, S.E. by E. 7 to 8. Sky after noon overcast with mist and snow; up to noon was clouded from $\frac{2}{10}$ ths to $\frac{3}{10}$ ths.

January 11th, Monday.—Hearing at breakfast a row in the dog-house I sent out to ascertain the cause and

learnt that "Lurcher" had been killed by "Bismarck." I found on examination that these two had been tied up too near each other and could just reach each other. I re-arranged all the dogs at proper intervals, and wired up their chains so that they cannot easily be moved or placed too close again. "Lurcher" was a capital sledge dog. It is very tiresome. These dogs are a constant source of anxiety to me, and I feel a relief each morning on hearing all is well with them and that no dog has been killed during the night.

I took out the half-plate and hand-cameras and took three negatives beyond Sharpe's Rock as the moon was bright. I then went for a ski run to the top of the east glacier which has been much cut up by the easterly gale, and the snow is in deep, hard furrows and high ridges. On my return, seizing the opportunity of a fine day and of being able to reach the open water, Bruce and I took down the tow-net and dragged it up and down for two hours' near the large berg. Among other things we got a new shrimp. A small species of shrimp (similar to some the doctor and I got away east some weeks ago) came out of the water beautifully efflorescent and remained so for some hours. I have requested Bruce not to go near the open water in the dark unless I am with him. The others went for a ski run on the plateau for exercise. Armitage tried an observation for longitude (absolute) with a moon-culminating-star but the sky became overcast and stopped it. He went on with the canoe. The doctor worked at the jumpers. Wilton weighed out tinned meat for the dogs when sledging.

Winds N. by E. 2 to 3. N. by E. 1 to 2. Calm, E. by N. 1. Sky clouded $\frac{2}{10}$ ths to $\frac{10}{10}$ ths. Misty after 6 P.M., and clouded over from the eastward.

January 14th, Thursday.—At 3 A.M. this morning I was roused by “Nimrod” yelling “Bear!!!” at the top of his voice. All the others were asleep and heard nothing. I slipped on some boots, and putting a coat over my pyjamas and taking my rifle I went out. At first I could see nothing owing to the thick overcast weather with a fresh easterly wind driving snow before it, and snow also was falling thickly, but on going round the barometer shed a big yellow object came full tilt at me. At a distance of about six yards I fired at his head end (I could not clearly distinguish it as it appeared merged in his body), and he dropped suddenly as if shot through the brain, but to my surprise on the effect of the flash of light clearing away I saw him pick himself up and make off to the right of the flagstaff, so I fired again after him. I at once loosed “Nimrod” and went back into the hut for a pair of mitts and a lantern to follow his tracks, as the noise of the wind and driving snow prevented my following by the sound of “Nimrod’s” barking. I tracked him down the slope and across the floe for some distance towards the big berg and open water, but lost his trail on a wide extent of hard, level, wind-swept floe, and as I could hear no sound of the dogs I had reluctantly to return to the hut. At 6 A.M. hearing a great racket amongst the dogs I guessed that the two bear dogs “Nimrod” and “Misere” had returned from their hunt and were having a difference of opinion upon professional matters. I got outside the hut just in time to rescue “Misere” who was muzzled, from being killed, whereas “Nimrod” was not. I tied up “Nimrod” and brought “Misere” into the hut for the night, and gave him some rum to pull him together. He had had a near squeak. They are fearful dogs for fighting!

Winds S.W. 1 to 2, N.N.W. 3, W. 3. Overcast and misty all day

except at 4 P.M., when the sky cleared $\frac{2}{10}$ ths and the mist lifted. At 8 P.M. it was snowing.

January 16th, Saturday.—Overcast and misty all day after 8 A.M. I went for a ski run up Windy Gully and on my return was told that the others had shot a bear just outside the house some time before and were now away to the westward. He had run west some distance badly wounded and had been finished there. Armitage, the doctor and Wilton did the shooting. I am told that the bear (a very large male seven feet five inches from nose to root of tail) showed considerable boldness and went for one of them when they approached, and again after being wounded faced about with the intention of charging. We sledged him up to No. 2 hut, where we skinned him. I am very glad to get him as we were without bears' meat. I then developed a number of negatives recently taken; Armitage worked out yesterday's longitude observation.

Winds E.S.E. 4, E. 5, E. by S. 4 to 5. E. by S. 3. Misty all day. Overcast after 8 P.M. (then sky $\frac{2}{10}$ ths clouded), snowing at noon. The mist was very wet after noon, coating everything with ice.

January 20th, Wednesday.—I, in common with the others, have been much troubled with sleeplessness. They all look rather pale. Darkness has a greater effect upon health than most people imagine. Sleeplessness affects the general health. Even the sleep one gets seems to be unrefreshing, and we get up feeling drowsy, and with headache in the morning, but quite unable to go to sleep. I have taken sulphonal once or twice but don't care to do so often, as its affect is as yet, I believe, unknown, and may be injurious.

January 21st, Thursday.—Wilton brought "Snark" into the house saying that his tail had been frozen to the ice and he did not seem well. I found on examination that

he had some nasty wounds on his hind quarters caused by "Pincher," no doubt at the same time as "Lurcher" was killed. I cut off the thick hair around the wounds, which hid them and accounted for nothing having been noticed before, and washed them out and sent for the doctor, who put some antiseptic dressing upon them. The dog is off his feed, is feverish, and the wounds smell badly. He is our best sledge dog. I am keeping him in the hut until he is better. The weather has been bad all day. Misty throughout and overcast in the morning and blowing in gusts of gale force (7) all day, and a steady gale in the evening from east-by-south, backing to north-east and east. I took some exercise around the pond and the others did the same at the back of the hut. Armitage worked at the canvas for the canoe. He is proving most efficient at the job. I went on with the tent, Wilton with the dog-meat. The doctor worked at the bearskin.

Winds E. by S. 2, N.E. 1 to 2, E. 2, E. 7. Gusts all day, sometimes shifting to northward, of forces 4 to 9.

I began an experiment on "Joey" to-day, feeding him on five ounces per day of a concentrated food, the pet child of a well-known food specialist, and weighing him daily. Ten ounces is said to be sufficient food for a man at hard work.

January 22nd, Friday.—A clear fine day for a change, but with a lower temperature—22° below zero, and enough wind to make it very cool. There was a good deal of twilight at noon to-day.

Many tracks of bears were visible even near the hut, showing that if we had good bear dogs we should have got more. Poor old "Räwing's" death is a sad loss to us.

Winds E. 2 to 3, E.S.E. 2, E.S.E. 4, S.E. by E. 2. Sky clouded $\frac{1}{10}$ th to $\frac{4}{10}$ ths.

“Snark” died last night, apparently of septicæmia.

Winds S.E. 0 to 1, E. 0 to 1, S.E. 0 to 1, N.N.E. 0 to 1. The sky cloudless all but 0.5 all day. The mercurial barometer registered at 8 P.M. 30.921 (uncorrected to sea level). The barometer has been above thirty inches since 8 A.M. on the 25th.

January 28th, Thursday.—Another beautifully clear fine day and with consequently a good deal of twilight. I went for a run on the floe to the east and the others went in the same direction some time before me. Sounds carried a very long way to-day, and I distinctly overheard a conversation at a distance of over half a mile from me, between two of my men, conducted in an ordinary tone. They were immensely surprised when, on our return to the hut, I repeated what had been said.

I began work upon my canoe in preparing it for sledging; Armitage worked out yesterday's astronomical observations; Wilton sewed sledge sails; the doctor went on with the tailoring, at which he is excellent.

Winds N.W. 0 to 1, N.N.E. 0 to 1. Calm. Sky clouded 0.5 at noon. Cloudless the rest of the day. Barometer began to fall after noon. Barometer at noon 30.972 (uncorrected to sea level).

January 30th, Saturday.—I found this morning that “Misere” is rapidly losing the hair round his neck where “Nimrod” bit him some time ago and is off his feed.

I fetched him into the hut, and the doctor and I put some dressing upon it and bandaged it up in flannel to keep it warm. I then tied him up with a chain round his loins, like a monkey, as a collar cannot be put round his neck without chafing, and he must be tied up or more rows will result.

As there appears no means of effectually stopping the fighting among the dogs, even by the utmost watchfulness and care, I mean to try what nipping off short

the canine teeth, which are those with which the damage is done, in the present and future pups will do. Although I hardly like doing it, some means must be found to check it, or we shall lose all our dogs soon. I sincerely hope ponies will be sent next summer—or at all events more dogs.

A SKI PARTY

February 3rd, Wednesday.—Misty until afternoon and the sky clouded from three-tenths to four-tenths. It then cleared. Temperature still low. Owing to the high tides there has been both about noon and this evening a good deal of ice-pressure to seaward, and the air has been filled with groans, shrieks, and whistles, varied by rumbling sounds like a distant, heavily laden train. I went for a ski-run to seaward beyond Bear Berg to get a view of the ice-pressure and then struck across towards Cape Gertrude. The others also went out on the floe.

I have given out fur "finsko" to the members of the party as the weather is now a trifle too cool for leather "laipeshko."

I went on with the canoe and then washed clothes, being occupied with them until after midnight. Armitage sewed the canvas canoe. "Daisy" gave birth to pups this afternoon.

Winds N.E. 0 to 1, E. 1 to 2, W.N.W. 2, E.N.E. 2. Sky clouded 0 to $\frac{1}{10}$ ths. Misty until after noon. The barometer has been falling during the last two days until 4 P.M. to-day (30.200 at 8 A.M. of 2nd, 29.909 at 4 P.M. to-day), when it began to rise.

February 9th, Monday.—As soon as I had finished my usual morning's work I ascended the talus by cutting steps in the hard snow, and after some trouble succeeded in getting down two of the pups, which have gone up there, and are afraid to come down again. I then set to work to try and find the third. I cut steps over several shoulders but saw nothing of it, and as darkness came on while I was up there I had to give up the search and come down. On arriving at the hut to my annoyance I learnt that two more pups had gone up the talus, and that the one I had been searching for had come down on its own account early in the day! I must try again to-morrow to fetch them down. I am now keeping all the small pups in the stable, day and night, as I have something else to do besides climbing the talus after them, which is not pleasant work either at this season, and a slip would smash one to pieces.

There is only a narrow stream of open water visible running east and west about two miles off Flagstaff Point and beyond that to the horizon (thirty miles distant) apparently a mixture of floes, broken up, and light bay-ice.

After tea we packed up sledging provisions, and Armitage worked at the canoe.

Winds N. 3 to 4, N.E. 3 to 4, N.E. 5. Sky clouded 0 to $\frac{1}{10}$ th.

February 9th, Tuesday.—We went on packing up provisions for sledging, and I added three more bamboos to the tent-frame, as I fear the four alone will not withstand some of the gales we are likely to meet with when sledging. During the last two years I have for an hour and a half every night, after turning into my blankets, read some scientific book. I am now engaged reading Darwin's "Origin of Species," which I have only read once before, and which is a work that requires studying.

Winds S.E. 0 to 1, N.W. 1, W.S.W. 1, W. 2. Sky clouded $\frac{1}{10}$ th to $\frac{1}{8}$ ths. Snowing (fine) at 8 P.M.

February 11th, Thursday.—This morning at noon, believing that I could hear yappings from the top of the talus, I sent Armitage with a glass round the foot of it to see if he could make out the missing pup. He returned saying that he could see it on the summit of a high shoulder under the rocks to the eastward six hundred feet up. As soon as I had finished breakfast I started off with ice-spikes and ice-axe, and by cutting steps in the steep, hard ice-slope, managed to reach it, but found it in a very bad way. I brought it into the hut and fed it on some meat extract and milk, and tried to give it some whisky. It was, however, seized with a tetanic-like convulsion and died. The poor little beast was frozen down when I found it and had got very thin.

Armitage took an observation for moon-culminating star for absolute longitude :

	E. Long.	
December 29th, 1895	49° 44' 37"	Moon-culminating star.
August 16th, 1895 .	50° 01' 44"	Lunar.
April 18th, 1896 . .	49° 39' 15"	Lunar.
February 11th, 1897 .	49° 28' 19"	Moon-culminating star.
<hr/>		
Mean	49° 43' 29"	

Latitude for Meridian Altitude of star B. Tauri. February 11th 1897. $79^{\circ} 55' 58''$ N. Latitude.

The fine, clear, calm, cold weather still continues and we all find it a delightful change from the usual climate here. The minimum thermometer has registered -39.5° F. below zero for the last twenty-four hours.

Winds calm all day. Sky clouded $\frac{1}{2}$ th at noon. Clear the rest of the day.

The temperature has been low during the last few days, the minimum for the 12th registered $50\frac{1}{2}^{\circ}$ below zero, and the wind increasing from the north-east to a fresh gale on the 13th, with a temperature varying between 44° and 50° below zero, has made it bitterly cold.

The gale blew throughout the night, and in spite of our efforts to keep up the warmth of the hut the temperature fell uncomfortably low, and at 8 A.M., at three feet from the floor and eight feet from the stove, which was well stoked, the thermometer registered 6° of frost. Nails, &c., at a short distance from the stove, driven into the wall, are coated with ice, and the north-east wall of my cabin is quite white from the same cause, and a perfect glacier runs down the wall from my breath condensing on it when asleep. I have had all the loose dogs brought into the hut, and all the animals under cover. We have now five dogs encamped in our room. I went out for a walk for two hours with a wind-guard on; all the others consider the inside of the hut the best place, in which I daresay they are right, but I dislike being kept in by anything.

At 8 A.M. the temperature had risen to 37° below zero, but the north-east gale still continues at force 8. It had moderated by noon to a moderate gale, and the temperature rose four degrees more. At 6 P.M. the

wind quickly fell to a gentle breeze at 8 P.M. from west by north.

About noon Wilton, who had shortly before gone out to the stable, ran in to tell me that a large bear was just outside the stable door, and was threatening the pony and dogs which he had just let out for a short run. I seized my rifle and ran out and found Wilton, who had preceded me by a few seconds, very pluckily "standing by" the stable to create a diversion in case the bear should collar any of the animals, and was about twenty yards only off him. I ran up and put a bullet through "Mr. Bruin's" head and settled him at once. The pony was coolly standing about ten paces off looking at him and showed no fear. I wish she would realise that bears are not nice or desirable acquaintances; but she doesn't a bit. "Daisy's" pups were barking around him, and fortunately distracted his attention as he was engaged in making rushes at them. They are becoming great sportsmen.

I praised Wilton for his pluck in standing by his farm in danger. All the dogs but the puppies were in the hut.

I photographed the bear, and we sledged him into No. 2 hut and flensed and cut him up. We found it difficult to see to do this, even with two lamps, owing to clouds of steam rising from the carcase and ourselves in the cold temperature, and at times could barely see each other a yard away. It looked like a laundry in full swing. I am very glad to get dog-meat. After skinning the bear every one amused themselves as they liked.

Winds N.E. 8, N.E. 7, W. by N. 2. Sky clouded 0 to $\frac{8}{10}$ ths. Misty at and after 4 P.M. Temperature rose to 29° below zero at 8 P.M.

February 17th, Wednesday.—I developed the negatives of the moon taken last night, and then made another

dog-trace of canvas. Armitage went on with the canoe. The doctor worked at the gaberdine cover for my breeches. Wilton weighed out and packed up dog-meat. Armitage has been anything but well during the last week. A tooth has been bothering him and he is generally out of sorts. The others are now looking well, and every one is sleeping better. Even the twilight we have had about noon for some days has improved every one's health, although when the first light began to make itself manifest, it seemed to have an adverse effect upon all for a few days. I have noticed similar effects during each of the three springs we have been here.

The dimensions of the new canoe which is partially finished are :—Length along keel, 10 ft. $7\frac{1}{2}$ in. ; length along deck, 11 ft. $9\frac{3}{4}$ in. ; length along bows, 1 ft. 8 in. ; length along centre ribs, 1 ft. $2\frac{1}{2}$ in. ; length along bottom pieces, $10\frac{1}{2}$ in. ; diameter of manhole, 1 ft. $9\frac{3}{4}$ in. fore and aft, 1 ft. $10\frac{1}{4}$ in. athwart ship ; depth at centre, 1 ft. $3\frac{1}{2}$ in. (from top of manhole to keel).

Armitage has made a capital job of it, and has turned out our new, and rather strange-looking, craft in a most workmanlike manner. I think she will answer admirably for sledging. Her weight is 60 lbs.

February 19th, Friday.—Blowing hard all night and with furious gusts which continued more or less all day with driving snow and mist. The low temperature of 36° below zero renders the wind rather nippy. I went for a walk on the plateau to the westward where it was a trifle sheltered from the high gale. The doctor, Wilton, and Armitage also went out for a short time.

I went on with the canvas dog harness. Wilton made bags for the dried vegetables I have been keeping for the pony's food while sledging. Armitage

worked at the canoe. The doctor worked at Armitage's jumper.

I have been very careful that none of the looms that are in the least degree high, shall be eaten by us. Through the winter either the doctor or I has carefully examined all loom-meat before it is cooked. We

THE END OF THE HUNT

also examine all tinned meats before they are used; we have to be very careful. We have kept scurvy at bay up to the present, and with proper care shall, I trust, do so.

February 20th, Saturday.—We only have now breakfast, tea (with a little bread or biscuit and butter), about 3 P.M., and dinner at 7.30 P.M. We have dispensed with lunch, as we found that during the winter we don't need it. Just before we had tea Wilton ran in to say that a bear was by the pond making rushes at the pups which were out there. I ran out with my rifle, but as the bear was then on the middle of the pond and the pups were in

no immediate danger, I went back into the hut and called Armitage and the doctor so that they might share the sport. We then went out and found "Mr. Bear" close to the observatory, and as he made one or two dangerous rushes at the pups and nearly caught one, I put a bullet into him, as he stood and glared at me, which

"WE SLEDGED HIM INTO NO. 2 HUT"

literally passed up his nose, knocking out an upper canine tooth on its way. He rolled over and then arose and staggered off, but a second shot in the neck from me, and one from Armitage following my first shot, knocked him out.

We sledged him into No. 2 hut and skinned and cut him up. He was a small he-bear and very lean. He was, however, as active as a cat, and rushed about in a very brisk manner. I am leaving this skin to freeze, and the doctor will attend to it after we have left for the

sledge journey. Only a small piece of canvas was in the stomach.

Winds N.E. 8, N.E. 7 to 8, various 1, N.E. 7. Sky clouded $\frac{1}{10}$ th to $\frac{2}{10}$ ths. Misty at 4 P.M.

SUNRISE AFTER THE LONG POLAR WINTER (FEBRUARY)

February 22nd, Monday.—The morning opened calm and clear. The sun rose after our long winter night, the upper limb showing above the horizon at 11 A.M. We welcomed him with joy, which no one but those who

have been deprived of light for four long dreary months can in the least appreciate, especially after four Arctic winters in succession, which I have now experienced, three being spent here. Next winter will make five. Quite a procession to the plateau was formed to see his friendly old face appear again in the sky, to watch him rise, little by little, above the ice-bound sea and band of frost-smoke on the southern horizon. Our gloomy, deathlike polar night is over, and we all stand well and full of vigour to welcome the return of life and brightness.

I took the half-plate camera and went some distance up the talus and obtained a number of negatives of the scene. The blendings of colour were very striking—gorgeous hues of rose, orange, pink, and purple being predominant from west, through south to east, while towards the north the sky had a steel-blue appearance near the horizon, becoming paler blue towards the zenith. The sun rose about $\frac{3}{4}$ of a degree and sank about 1 P.M.

The results of my experiments upon "Joey" with the "concentrated" food show that it does not come up to what is claimed for it. The dog was chained up and muzzled all the time to prevent the possibility of his getting extra food, and I carefully weighed him every morning before feeding him. He took the food readily at first, but towards the end of the experiment very reluctantly, and on the three last days* I had to put about half his allowance down him. He got very thin, but otherwise appeared in good health. During very cold weather he was kept in the stable, which is warmer than the dog-house.

It is claimed that ten ounces per day will enable a man to work hard and keep in good health in the Arctic.

* Omitting the last day but one.

EAST END OF CAPE FLORA IN MARCH



I have no desire to try it upon ourselves when on a sledge journey.

		Weight of		Concentrated			Weight of		Concentrated
		dog.		food.			dog.		food.
		lbs.		ozs.			lbs.		ozs.
January	24th	38½	...	5	February	6th	31	...	7½
"	25th	37½	...	5	"	7th	31	...	7½
"	26th	36½	...	5	"	8th	31	...	7½
"	27th	36	...	5	"	9th	30	...	7½
"	28th	34½	...	5	"	10th	29	...	7½
"	29th	34	...	5	"	11th	29	...	7½
"	30th	34	...	5	"	12th	28½	...	7½
"	31st	33	...	5	"	13th	28	...	10
February	1st	32	...	5	"	*14th	28	...	10
"	2nd	31½	...	7½	"	*15th	28½	...	10
"	3rd	31½	...	7½	"	16th	28½	...	10
"	4th	31½	...	7½	"	*17th	28	...	10
"	5th	31½	...	7½					

February 25th, Thursday.—As I have only fifty-two pounds of oats, I am obliged to take Spratt's dog biscuits in the place of them to use with the dried vegetables I have saved for "Brownie" when sledging. These are excellent dog food, but the proprietors would hardly recommend them for horses!

I went on making dog harness. Armitage made a green canvas bag for his sledging kit. The doctor finished the jumper for Armitage. Wilton weighed out and packed up dog biscuits for pony food when sledging.

After breakfast we covered over the south-west window of the hut—which is very thickly coated with ice, so that it nearly excludes all light—with four thicknesses of reindeer skin externally, and piled snow up against it to enable the warmth of the room to overcome the external cold and melt the ice off.

February 28th, Sunday.—This morning Wilton and I went to the top of Cape Flora, as I wished to examine

* Had to be forced to eat the allowance.

the self-registering thermometers I had placed there last autumn. I found the minimum showed -63° below zero, and the maximum $+20^{\circ}$. As there is a difference of as much as twelve degrees between the minimum registered here throughout the winter and the one on the summit (about 1000 ft.), I think there must be an error on the in-

WILTON EXERCISING THE DOGS

strument, although last October it agreed with our standard thermometers. I shall compare it with others when it is brought down. I am leaving the thermometers, after re-setting them, on the summit for a month or two longer.

March 3rd, Wednesday.—Two of "Miss Råwing's" pups were found dead this morning, now leaving only one. The odd, tiresome little beast kills and eats them in spite of all our care.

I see a report in the *Weekly Times* of April 24, 1896, of the discovery of a method of colour photography by

WEST END OF CAPE FLORA IN SPRING



M. Lippmann, which appears to require only a mirror of mercury behind the plate in the dark slide in addition to the ordinary methods of procedure. I intend to cut up for the purpose a looking-glass brought up from the ship and try it, although I don't quite see how it is going to act.

We want another bear badly for dog meat, for during the last two days we have been without any, and they have been having tinned instead.

Winds N. 1 to 2, W.N.W. 1 to 2, N.N.W. 1. Calm. Sky clouded $\frac{8}{10}$ ths to $\frac{10}{10}$ ths. Snowing (fine snow) and misty at 8 P.M.

March 8th, Monday.—None of us went for our usual walk to-day, but only took a few minutes' exercise near the hut, as I am very anxious to put in every minute we can in making preparations to leave for the sledge journey.

I did a variety of odd jobs—made muzzles, fixed up furs, &c., and then went on with my work at the canoe. Armitage spent the day fixing up his militza. Bruce finished my jumper bag, and then I set him to work to remove the glasses from our goggles and to insert black kid with a slit in it in place of them. This I think will be an improvement in case we want to use them. Wilton let pieces into the sleeves of my militza. The doctor finished the gaberdine covers for Armitage's breeches, and washed out some woollen stuff to make mitts, &c., from.

All are working with most hearty good-will to enable us to get off quickly, and we kept at it until after 8 P.M. to-night without any break except a few minutes to have tea and bread and butter at 3 P.M. There is a popular impression that people in the Arctic live a life of hibernation during the winter. That certainly is not the case with us ; we are always busy, and the time seems too

short to enable us to do all we wish to. Having plenty to do keeps us happy, contented, and in good health, and that combined with regular exercise and a proper care as to wholesome food is the secret of passing the long dreary months of Polar darkness in health and happiness. Work is a saving clause in our lives.

I finished and lashed the chocks made of cork and reindeer-skin upon the 11 ft. 6 in. sledge to carry my canoe. We are very glad to be free of canoes in the hut, which have much taken up our very limited space for over a month past. One had been slung across the room after being tarred, and our heads have constantly been coming in contact with its very sticky sides, causing much laughter and endless jokes. Wilton gave me a hand with the canoe. Bruce began a cover of gaberdine for the fur bag I use for dark slides. The doctor began some gaberdine covers for our fur mitts. Armitage finished washing his clothes and repairing his militza.

March 13th, Saturday.—I continued my work at loading up the sledges, and by seven o'clock had got six packed and under the sail-tenting on the thaw-water pond ready to start. I shall have a few finishing jobs to do to-morrow, and I intend unless the weather is very bad to start on Monday.

List of Provisions for Two Men for a Week.

Tea, 1 lb.	Biscuits, 14 lbs.
Cocoa, 1 lb.	Cooked loom meat, 14 lbs.
Sugar, 4 lbs.	Butter, 1 lb. 6 oz.
Soup, 1 $\frac{3}{4}$ lbs. Bospur, 7 tins.	Concentrated meat juice, 2 lbs.
Lentil, 3 lbs.	2 oz.
Lard, 1 lb.	Cheese, 2 lbs. 11 oz.
	Bacon, 3 lbs. 8 oz.

WE PREPARE AGAIN FOR SLEDGING 187

NO. 1 BAG CONTAINS IN ADDITION—

Salt, 2 lbs.	Candles, 10.
Pepper, 4 oz.	Flags (Jacks), 4. (for cairns)
Spoons, 2.	Frying-pans (aluminium), 2.
Tomahawk, 1.	

NO. 4 CONTAINS ALSO—

Salt, 2 lbs.

Weights of Ration Bags.

	lbs.		lbs.
No. 1 Bag . . .	63	No. 4 Bag . . .	55
" 2 " . . .	54	" 5 " . . .	54
" 3 " . . .	54	" 6 " . . .	55

Weights on Sledges.

NO. 1 SLEDGE.

	lbs.		lbs.
No. 1 Ration bag, &c. .	66	Tinned dog meat (wrapped	
" 2 Soviek, &c. .	24	in 1-lb. lots in paper) .	50
" 2 Skin breeches .	8	Pony's gear . . .	10
Bag of dried vegetables .	24	Tent, poles, &c. . .	30
Dog cakes . . .	50	Shovel . . .	4½
Two kit bags . . .			28 lbs.

NO. 2 SLEDGE.

Canvas canoe, and gear, 65 lbs.	Raper's tables.
Gun in case, 9 lbs.	Scribbling-book.
Militza, 10 lbs.	Paddle.
Tinned dog meat, 50 lbs.	Sail and mast.
Artificial horizon.	One tin whiskey.
Thermometers (case).	One canteen.
Aneroid.	

NO. 3 SLEDGE.

	lbs.
Ration bag, No. 2	54
" 3	54
" 4	55
" 5	54
" 6	55
Tinned dog meat (wrapped in paper in 1-lb. lots)	50

NO. 4 SLEDGE.

	lbs.
Oats, 52 lbs. }	= 118
Dog cakes, 66 lbs. }	
5 bags of dried vegetables of 28 lbs. each	= 140
1 bag " 56 " . . .	= 56
1 bag " 28 " . . .	= 28

NO. 5 SLEDGE.

	lbs.
11 tins of 1 gallon of spirit (11 lbs. each) . . .	121
1 bag of tinned meat (for dogs) . . .	45
" " . . .	72
" " . . .	62
1 bag of dried vegetables . . .	28

WEIGHTS.

313½	} pony.	141	} 12 dogs.
185		314	
322		328	
<hr/> 820½		<hr/> 783	

NO. 6 SLEDGE. 11-FT. 6-IN.

Birch bark canoe (decked in), 75 lbs.	Bacon, for lunch.
Rifle, in case, 9½ lbs.	Cheese.
Camera (half-plate), &c., 12 lbs.	Prismatic compass.
Bag of dark slides.	Telescope.
Changing bag.	Stand (camera and prismatic compass).
110 half-plate films.	Hand camera.
100 hand-camera films.	Paddle.
Crow-bar, 4½ lbs.	Sail and mast.
Cartridges (12-bore), 7 lbs.	Lantern (Beresford).
One gallon spirit, 10 lbs.	Sextant.
Canteen (with two quart pots), 8 lbs.	Two knives and steel in bag.
Militza, 10 lbs.	
Bag of biscuits.	

Nos. 1, 2, 3, 4 and 5 sledges measured 9 ft. 6 in.

I am giving the pony six pounds of dried vegetables and four pounds of either dog cakes or oats daily. To the dogs I give one pound of tinned meat to each daily. Both the pony and dogs are in first-class condition, and

have fully rewarded my efforts to get them fit. The dog team is, however, a weak one, and out of the twelve dogs two are entirely new hands and three are weedy animals.

The weather is warm, misty, and snowing—bad for sledging.

Wilton did some odd jobs and helped me to load up. The doctor started to make gaberdine covers for our mitts. Armitage did various odd jobs and lashed on the canvas canoe.

Winds calm all day with force 2 at 8 P.M. Overcast and misty all day until 8 A.M. The wind was varying to N.E., but there was a sound in the cliff-tops of a southerly wind, and cirrus-cumulus clouds have been moving from S.W. over the moon.

I heard roches up in the cliffs of Cape Flora to-day. It is pleasant to have the long winter silence broken again by the familiar cries of birds.

I intend to proceed up the British Channel round the northern shores of the western land, and make out its extension to the westward—we know not the extent of it or the direction the land takes beyond Cape Mary Harmsworth—to determine the extent and position of Gillis Land, if such a land exists, mapping in all country seen *en route*, and returning round Cape Mary Harmsworth and the western southern coast to Cape Flora. In the spring of 1898, having practically mapped in what remains of Franz Josef Land, I intend to push north *viâ* the east coast of Crown Prince Rudolf's Land to explore the sea to the north of Franz Josef Land to the west of Nansen's route, and attain as high a northern latitude as possible. I trust by then to have my draft-power much increased by ponies by the ship this coming summer.

CHAPTER XXVIII

QUEEN VICTORIA SEA AND THE NORTH-WEST

5th, 1897,
An entire
ice weather.
A wind from
the north
brought the ther-
mometer again to
zero at

We
hurried
up and
got the
sledges
down on
to the
floe and
got a-
way,

DRESSED FOR SLEDGING

making for Windward Island. All the members of the party accompanied us, so as to help us on our first day's journey with our loads. The animals started well but soon began to flag, and we had great trouble to get both the pony, our last remaining one, and dogs along. We are very short of draft power.

We stopped for lunch about midway between Cape Flora and Windward Island (the thermometer standing

at 30° below zero) and then pushed on again over level floes but very deep with snow, so that I was obliged already to put the pony into the snow-boots I have made for her. We all use ski.

We camped about 8 P.M. after ten hours going about half a mile to the South of Windward Island where we came upon hummocks; the animals were fairly done up, owing to the snow lying deep, making the going very heavy. The thermometer had then fallen to 40° below zero (a fall from $+24^{\circ}$ at 8 P.M. last night or 64° within twenty-four hours. All the rest of the party then started back for Cape Flora. I thanked them all for the way in which they had helped me in getting through the sledging preparations, and their hearty and cheerful co-operation in the work of the Expedition generally. They gave us three cheers and an extra one, on leaving, and expressed their best wishes for a successful journey. Armitage and I were then left alone to proceed on our third year's journey. A breeze sprang up in the course of the evening making 40° below zero a bit cool.

I muzzled all the dogs, knowing their propensity for killing one another and gnawing their harness, and left them in their traces with the hauling line stretched from a hummock to the sledges.

Travelled eight miles.

March 16th, Tuesday.—During the night the wind got up and snow fell, and this morning it was still blowing a gale from north with thickly falling and driving snow, and a dense mist which cut off all view more than fifty yards from camp. We are obliged to remain here until it improves. This weather continued the same all day. The thermometers had risen to -12° below zero this morning. Extraordinary fluctuations! The wind

dropped late in the evening but snow continued to fall thickly.

The weather is anything but promising; we have been waiting for twelve months, looking forward to this journey, to the renewal of a life of more action than we have at the hut, and to being again able to add more coast lines, islands and fjords to the map we have

"BROWNIE," OUR PONY

begun. The long period of comparative inaction, during which active exploration cannot be carried on, is very trying.

March 17th, Wednesday.—Overcast, misty, and fine snow falling. "Brownie" got loose during the night and ate a day's allowance of vegetables at a sitting by tearing open a bag on a sledge, and this morning I found her crammed to repletion standing by a torn open bag and utterly unable to get down an ounce more. Her proportions were truly aldermanic. It will do her harm I fear.

Dug out the drifted-under sledges, straightened

things up, and got underweigh through very deep snow, which rendered going bad for the animals and progress slow. I went ahead with the pony and her sledges to lead the way. Armitage followed with the dog team.

On nearing Windward Island I took three negatives of it. I went on ski, and fixed a Jack amongst the rocks on the south-east slope of the Island. It is composed of weathered, broken-down basaltic cliffs rising about two hundred feet at the north-east end, and slopes gradually down towards Bruce Island. It runs south-west and north-east about a mile, and is about half a mile in breadth. It is bare of snow in summer and there is no ice cap. A few rotches were to be seen about the rocks. Travelled about seven miles N.N.E. and then camped at 6 P.M.

March 18th, Thursday.—Started shortly after 10 A.M. in a dense mist, overcast sky, and snow falling heavily. This condition of weather lasted all day. Our course lay through broken-up ice amongst which the snow was very deep, and the pony in spite of her boots sank deeply and gave me much trouble to get her along at all. On several occasions near bergs we came upon water beneath the snow. We passed over a very low, small, stony island off the coast of Bruce Island, half an hour after leaving camp, which we had never seen before.

I fear the pony's surfeit on vegetables the night before last has deranged her bowels. She has symptoms which give me great uneasiness. Unfortunately we have no aloes or any other horse medicine.

I steered north-by-east and stopped at 6.45 P.M. having travelled about ten miles.

March 19th, Friday.—The morning opened clear,

but the horizon is still misty. I took bearings of the Rubini Rock which lies nearly true east of us.

There appears to be no definite cape, such as Peterhead is represented as being, but only curving lines of glaciated coast.

I took two or three bearings on turning out. The land at Peterhead is low and entirely ice-capped with a glacier face curving round to the north and forming Clements' Markham Bay, the outlines of which I had mapped in in misty weather last spring, and which I now find necessary somewhat to alter after a clearer view. Not a rock or speck of bare earth is visible, nothing but snow and ice as far as the eye can reach. Away to the westward the rolling glacier-slopes of Prince George's Land* almost obscured by mist, blend with the grey sky; all is dim and silent, no sign of life is there, the Frost King reigns supreme, and it looks truly the land of the dead.

The weather cleared somewhat but remained more or less misty all day, and became very thick again after 2 P.M. Passed over fairly level floes but very deep in snow.

The pony is anything but well and is going badly. She evidently is seriously deranged as a result of her stolen gorge of dried vegetables. I have no medicine except a few pills. Came across more water under the snow to-day which "Brownie" floundered into and gave me some trouble to haul her sledges out of.

Peterhead does not come quite as far east as Mr. Leigh Smith has noted on his map, and the coast curves round towards the north instead of coming to an abrupt point at Peterhead. It was doubtless misty when he steamed up towards Eaton Island in the *Eira*.

* So named by me after H.R.H. Prince George of Wales.

Proceeded north 10° east about ten miles.

March 20th, Saturday.—The pony is no better and is seriously ill, and will certainly die if I cannot relieve her. I collected mine and Armitage's pills to try and make up a dose for her, consisting of twelve blue pills, four podophyllin and six of Armitage's especial brand, making twenty-two in all, and these I placed in frozen fat from our frying-pan and wrapped in paper and forced down her, I trust it may put her right or she will say good-bye to us soon.

The same dreary, misty, snowy weather continues. We have only had one clear day (the first out) since leaving the hut, and it has snowed almost unceasingly ever since. The wind has been chiefly north-easterly bringing up bank after bank of mist, rendering it often impossible to see anything even five yards off clearly, and picking a way through the hummocks and deep snow is very difficult. Continued our course going about north-by-west towards the eastern point of the land. The going is excessively bad, being the greater part of the day through broken, crushed-up ice, full of pit-falls, and the snow is lying deep and soft with only a slight crust upon it. It is one constant process of getting the pony and dogs out of holes and pulling up the sledges, taking sometimes half an hour to go a hundred yards. Over part of the course Armitage and I had to go thrice, taking one team at a time, and by dint of shouting and hauling got them along somehow. We and the animals were thoroughly tired out when we stopped at 6.45 P.M.

Course about north-by-west. Distance about six miles made good.

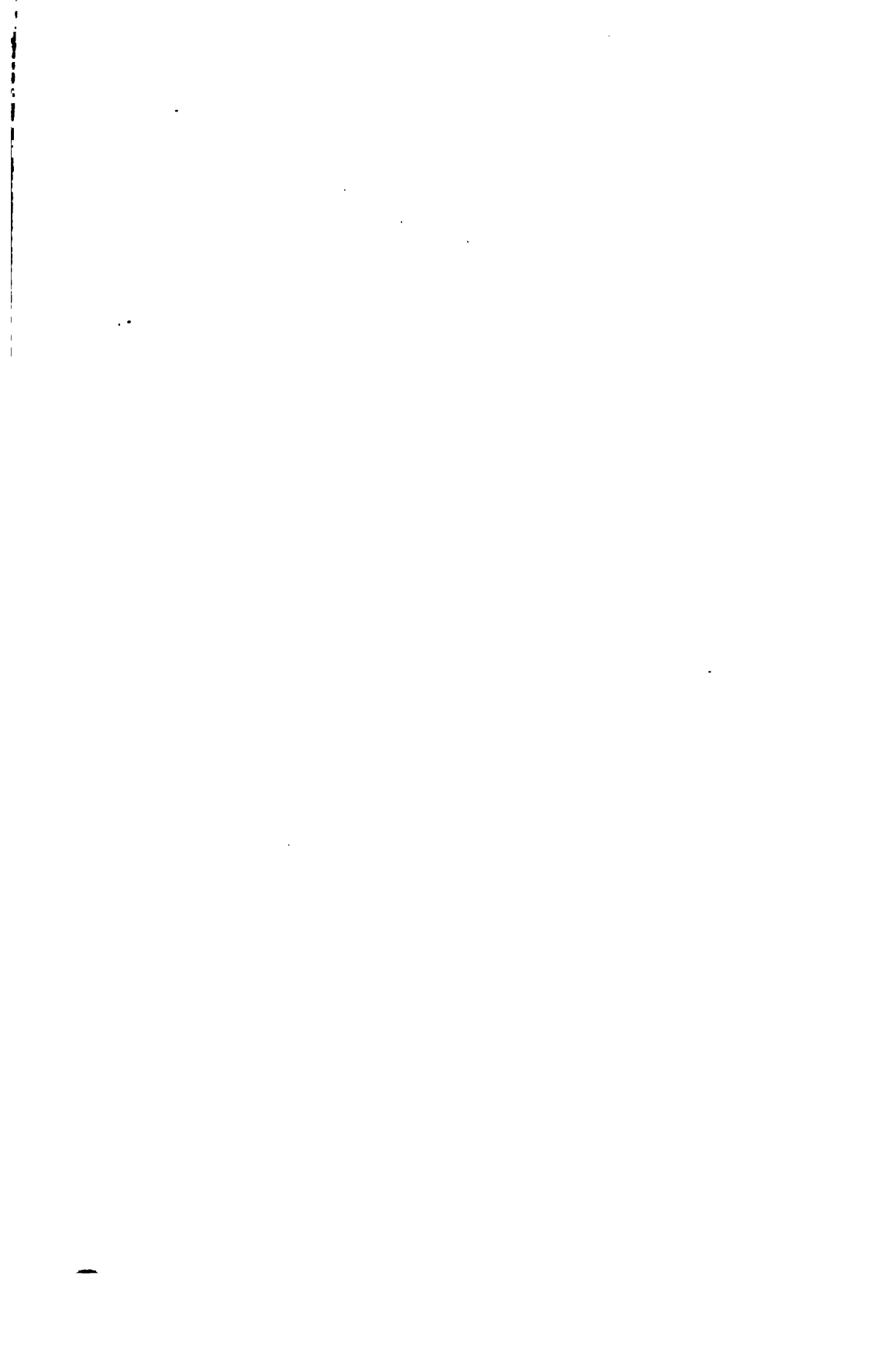
March 21st, Sunday.—Found the pony clean off her feed this morning, and looking very sick, poor beast.

As the horizon partly cleared, showing land at a great distance to the east of us and the western land as far as a point about north-north-east of us, I made sketches and took a few bearings and photos of the camp. We then started towards the point to the north-north-east through the abominable ice and deep snow over which we have been travelling the last day or two. "Brownie" at once broke down. She lay on the snow groaning, and refused to budge an inch. Poor thing, she had a minute before strained her off fore shoulder in one of the nasty trappy holes. I let her lie there to recover, and Armitage and I took on the dog team, and by constant whipping-up, shouting, and dragging up the sledges, got them through the broken-up ice on to some somewhat smoother a mile ahead. We then left the dog sledges and took the dogs back to where we had left the poor pony, and found her still on the ice. It is miserable work getting along a sick animal, but we must push on and cannot remain here.

We had some lunch, and then hitching up the dogs to two sledges and the pony to one, we got them as far as the advanced sledges, where, the going being better and "Brownie" somewhat recovered, we harnessed up again on our original method, but changed the order of the sledges. The going now improved, and we got ahead about two and a half miles when the darkness called a halt. Armitage then found that he had left his sheath-knife on the snow where we had hitched up again. I went back for it a distance of two and a half miles while he straightened up the camp. It came on very misty again after 4 P.M. and the sky became overcast. The thermometer stood at 23° below zero when we camped.

We travelled north-north-east about four miles. We

"THE GOING IS EXCESSIVELY BAD, BEING THE GREATER PART OF THE DAY THROUGH BROKEN,
CRUSHED-UP ICE, FULL OF PIT-FALLS"



uncoupled "Worm" as he was doing no work and was only in the way, and he appears to have disappeared and returned to Cape Flora. He was following behind me for some distance, but I was too much engaged to notice that he had departed.

March 22nd, Monday.—Overcast, misty and snowing. This filthy weather does stick to us!

Started to round the point to the northward of us. The pony, which is very sick and lame too, although the pills have done her good, soon gave up, lay down, and refused to budge an inch. I find it very hard work trying to get her along. As I could not move her, I let her lie quiet, and Armitage and I took on the dog team and then returned with the dogs and brought on the pony's sledges. The snow is terribly deep, with ugly traps among the broken-up ice, and the dogs go along laboriously and with many stoppages and frequent upsets. We stopped at 8 P.M. after a heavy day's work and disappointingly little progress.

Our horizon has been misty, and is every day bounded by a dim circle of fifty yards, except the first one out. There has been an incessant fall of snow, and very deep drifts and broken-up ice to clamber over. Took a meridian altitude for latitude. We covered about three miles in a northerly direction.

March 23rd, Tuesday.—On turning out the temperature had fallen to 27° below zero, with a light south-west breeze and a clear sky for a change, and without much mist. The land showed up on the eastern side of the British Channel, but with the exception of Capes Richthofen, Sybil and Fisher, I could not identify points owing to the distance. I took a telescopic negative of Cape Richthofen, which then bore $46\frac{1}{2}^{\circ}$ (magnetic) from us.

"Brownie," poor beast, goes very indifferently and lay down several times, and only by incessant urging can I get her along at all. It is miserable work driving a sick animal, although she is better than she was, but we cannot remain here. The dogs went, if anything,

"'BROWNIE,' POOR BEAST, GOES VERY INDIFFERENTLY AND LAY DOWN SEVERAL TIMES, AND ONLY BY INCESSANT URGING CAN I GET HER ALONG AT ALL"

still worse, and Armitage was continually far behind, necessitating my leaving the pony to help him.

After lunch we got on to harder and somewhat less sticky snow, and "Brownie" went better, but not so the dogs. "Charles" and "Hyena" both refused to eat anything on reaching camp in the evening. We have a wretched lot of animals.

I followed a north-north-east course (magnetic) along the glacier edge, and we covered about seven miles. The land is entirely glaciated, and rises to a height of about seven hundred feet at the sky line as far as we can see.

The greatest height of land we have found in Franz Josef Land is about 2000 ft. Not a stone or bit of earth is to be seen but only one ice-covered surface. The thermometer stood at 33° below zero when we camped, and fell to -36° below later on in the evening. The land on the eastern side of the British Channel is higher than on this side, and Hooker Island is about 2000 ft. at the dividing ridge, the highest point, from which the ice flows in different directions.

At lunch time Cape Fisher bore $31\frac{1}{2}^{\circ}$ and Cape Richthofen $45\frac{1}{2}^{\circ}$ (both magnetic), with Brown Fjord* running up between them, could be plainly seen. At the head was distant land, doubtless Cape Farman.†

Armitage took a meridian altitude for latitude.

March 24th, Wednesday.—Blowing a strong breeze from the north when we turned out at 6 A.M., which rapidly increased to a fresh gale from north-west, with a blinding, suffocating snow-drift. Nothing to do but to wait in patience till it is better. This state of the weather continued all day until 5 P.M., when it suddenly ceased, and then it blew in gusts from all round the compass. At 7 P.M. the wind got back into the north-west again, increased in force, and the sky became overcast and misty. We sat in our cramped quarters inside the tent doing any odd jobs that might be necessary, and endeavouring to keep ourselves warm; only going outside to feed the animals or to perform any duty that might be necessary. So we spent the day.

Armitage and I on the wind dropping dug the sledges out of the drifts in which they were completely buried, and straightened things up a little.

* So named by me after Captain Brown, skipper of the *Windward* in 1896 and 1897.

† Called after Mr. Edgar Farman by me.

March 25th, Thursday.—A great improvement in the weather, and the gale has hardened the snow beautifully. Our spirits rise as our prospects seem better, for we have had a most unpleasant ten days. We got under weigh, and directed our course round the point to the north which rounds off and turns westerly. Very high undulating glacier face lines the entire coast, being as high as 80 ft. in places; sometimes in front of a high ice-dome (submerged bluff) it sinks to as low as ten or twelve feet, and then again rises to as high as eighty feet. About five miles round the point a plateau, strewn with jagged basaltic boulders of a height of 300 ft., which I have named Cape John Murray after Dr., now Sir John Murray, presents the only exposed land we have seen along this coast. This headland has glacier in front of it, by which I ascended to the plateau in the fierce gale and driving snow, and made what examinations I could under the circumstances. The ice is here much broken up, cracks with water in them being frequent, and a tide crack (four feet wide) running along the glacier face appears to have more movement in it than in those farther south. Perhaps we get the Polar basin tide here. The south-west wind (force 4 to 6), which we utilised for our sails, helped us along in fine style, but rapidly increased, and at 5 P.M. had become a fresh gale. with dense driving snow. We pushed on for two hours longer, but the snow and mist had become so thick that we could hardly see the ice-precipices of the glacier face sixty yards away; I could barely distinguish Armitage a dozen yards behind, occasionally losing sight of him entirely, and had to stop, or I should have lost him. The drift became so dense on rounding a turn of the glacier, where we found ourselves somewhat out of the wind, but in a perfect whirl of blinding, suffocating snowy

particles, in fact, in a backwater of the storm, as to cut off all view more than three yards distant. It was with great difficulty, by groping about in this semi-darkness, I found a small hummock close to the glacier face, 80 ft. above us, and there stopped as further progress was impossible. Under considerable difficulties we at last

DOG TEAM UNDERWEIGH WITH SAIL

got the tent up. The tide crack opened in an unpleasant manner, suggesting the possibility of the floe going off, and taking us off to sea upon it. Having got our things into the tent, the dogs and pony fed, we proceed to make ourselves as comfortable as circumstances would allow. Our socks and the grass in our boots, made wet with condensed perspiration, changed for others, and the moist socks and mitts placed upon our chests to dry, which is the only means possible, as of course we can never have a fire when sledging; then having put on our furs and cooked our dinner of frozen loom meat over a

spirit-lamp, we lay down to sleep. We had hardly done so when an ominous roar close at hand, followed by two more, roused us up, and we craned our necks out of the tent to endeavour to ascertain the cause. Is the glacier discharging bergs close at hand? It sounds like it. If so, our position close to it, to say the least, is not a pleasant one! However, we could see nothing through the blinding snow, so we lay down again and decided to chance it. Once or twice this noise like thunder is repeated. On the occurrence of these sounds we felt very uneasy, and were in momentary expectation that a mass of ice, weighing hundreds of tons, would crash down upon us. However, it could not be helped, as we could not see to move our camp, and in such weather we felt we might easily step out of the frying-pan into the fire.

It is a climate! The gale continued all night with a blinding drift, filling everything with snow, and our camp was one of unmitigated discomfort. Possibly the southwest gale—almost unknown at Cape Flora—is caused by the wind blowing up the glaciated country to the open water to the north.

Many bear tracks and bird dirt indicate open water being near.

March 26th, Friday.—This morning we found that several avalanches of snow had slipped off the glacier above us on to the floe beneath, twenty-five yards from our tent; and that the weight of the snow had so borne down the ice as to force the water up. I found "Brownie" standing up to her knees in it, and water permeating through the snow upon which we are lying, soaking our belongings.

The gale is still blowing, and the snow driving as hard as ever, with a temperature of from 15° to 20° below zero.

ON THE MARCH

There was nothing for it but to pack up with all speed before matters became worse, and we were quite submerged ; so in spite of the utterly vile weather, we had to move on, as a further snowslip from the glacier might place us in the sea itself, and our quarters were not the acme of comfort as it was. The sledges were buried three feet down under hard snow, with only one or two of the top packages showing, and the tent we were in was half buried, although we had been here only a few hours. Under considerable difficulty, and after three hours' digging, we got things upon the sledges and started in a strong gale from south-west with dense driving snow. We struck out from the glacier face, and after going about a mile, found a spot protected somewhat from the wind by a pile of broken-up ice, where we again camped until the gale moderated. Armitage and I both got our noses and cheeks frozen in the process, and I both my wrists, upon which appeared large blisters in the course of a few hours, which later become troublesome sores as large as half-crown pieces.

This looks a fearfully wind-stricken spot ; all the ice away from the glacier being cut clean of all snow, and in places the ice is quite polished by the wind.

March 27th, Saturday.—The morning opened overcast, but clear to the eastward, and I took a number of bearings of recognisable points (Capes Fisher, Sybil, Alice Armitage, Richthofen, Cape Polar Gleams, southern curve of Koettlitz Island, and Cape Albert Markham), and was thus able to fix our position here. The sky cleared later, and a really beautiful day opened up, which is a treat, indeed. I took a number of negatives of the coast line before leaving camp, and then proceeded along the coast at about a mile distant from it towards the north-eastern point of the land. Arthur Island to the

north,* which appears to be entirely glaciated, now shows up. A few rocky cliffs of columnar basalt crop out of the ice near the shores of Prince George's Land.

After having lunch, what had appeared to be a bay, now, on opening up, suggests a fjord breaking up the land into islands. To endeavour to clear this matter up I set Armitage at 6 P.M. to make the camp, while I started off on ski to ascend a rocky headland, about four hundred feet high, of weathered columnar basalt, at the southern entrance to the bay or fjord about two miles off, which I named St. Chad's Head, after my old school, Denstone College. On reaching this I could see the bay or fjord was about five miles wide and about twelve miles long, and lined with basaltic cliffs with high country surrounding it. This fjord I named after The Right Honourable Joseph Chamberlain, M.P., Chamberlain Fjord. I could not ascertain for certain if it runs out to the sea beyond, but it appears to do so in a W.S.W. direction, turning again north-west. Only a few lichens and mosses represent the vegetation on the headland, so far as I could ascertain, at this season of the year. It has a talus of basaltic *débris*, around which a few rotches were flying. I could find no driftwood upon St. Chad's Head, although I searched carefully for it. I noticed again to-day recent bear tracks following the tide cracks. Doubtless seals frequently winter in these cracks instead of going south, otherwise bears would not make them their hunting ground. I could see no open water, but only a dark sky to the north indicative of it. There is no open water as far south as last year, and Cape M'Clintock has ice running between it and Arthur Island to the north of us. All this portion of the British

* Named by me after my brother, Arthur Jackson.

Channel, as far south on the western side as Cape John Murray was open sea, and almost devoid of ice last spring, now it is frozen over with light unstable ice, with open cracks running through it as far as the eye can reach.

The cape at the northern entrance to Chamberlain

THE BRITISH CHANNEL AND ALBERT ARMITAGE ISLAND

Fjord I named Cape Grosvenor, after the London club that has shown me so much hospitality and kindness.

Travelled N. 27 W. about six miles.

March 28th, Sunday.—Another fine clear day. After taking a few negatives we set out towards the north-east point of the land. We had to deviate towards the shore somewhat to avoid very rough ice, going north-west by north about five miles, stopping for food with Cape Grosvenor exactly west of us. The scene is extremely desolate. To the north the shield-like outlines of Arthur Island blend its icy slopes with the grey sky beyond. To the north-north-east nothing can be seen but an interminable expanse of ice. The bold white outlines of

Albert Armitage Island * are only broken here and there by darker basaltic rocks appearing through the ice-cap at intervals at the northern and southern extremes of the land. On the eastern side of the British Channel Capes M'Clintock, Fisher, and Richthofen are dimly visible. Capes Polar Gleams and Albert Markham have now sunk below the south-easterly horizon.

The pony, which has been better since her dose, now shows signs of being deranged again. "Hyena" is going very badly and is of little use. The bad weather has tried the animals very much.

After lunch we crossed several wide-open cracks with water in them, and we had to take the pony out of the sledges and drag her over and push the sledges over afterwards. This delayed us very much, and we did not round the headland until 7 P.M. I stopped several times to take bearings and negatives. Capes Fisher and Richthofen being fixed by astronomical observations are very useful in determining positions along this coast by cross-bearings. There has been very great pressure in Leigh Smith Sound—named so by me after the gentleman whose bold and successful voyages and excellent geographical work paved the way for my own expedition—and the ice in the neighbourhood of Cape Bruce is in a very rough and tumbled condition. There is, however, little snow upon it, all having been blown off, and it suggests that along this coast almost constant gales are blowing, which evidently by the direction of the sastrugi of the snow, is principally from south-west. On rounding the cape the land trends south-west in a wide curve, with a headland about eighty feet high and apparently ice free lying about six miles off. This headland I named Cape Battenberg, after Prince Henry of Battenberg,

* Named by me after my comrade, Mr. Albert B. Armitage.

who sacrificed his life in serving Great Britain, his adopted country. After helping Armitage to form the camp I walked to the rocks, half a mile off, and climbed the stony talus of the basaltic cliffs, which are about five hundred feet high; and took bearings and sketches of all visible land. I could see no signs of land to the north not previously mapped by me. The cape is very barren, and only a few lichens (red, black, and grey) and a laminaria, which I got in the tide crack, were found to represent vegetation. Rotches were flying near the Cape. I also noticed the signs of foxes and saw a few dovekies.

March 29th, Monday.—Misty, snowing, overcast, and blowing a gale from south-west. Shall have to camp till it clears a bit. These endless bad weather camps are very trying to men and animals, and we are heartily sick of them. The weariness of delay and inaction, combined with the acme of discomfort, is not exhilarating by any means. We sit in the tent trying to keep warm, and speculating upon where and how far the land to the westward goes and what distance we shall have to travel to go round it. We endeavour to do small jobs, such as repairing the dog traces, which being coated with ice and frozen as hard as steel bands is cool and tiresome work, and we have constantly to thrust our numbed hands into our pockets to restore the circulation to them and to thaw out the finger-tips. The bitter blizzard still continues and the only sounds heard are the roars of the wind and the howls and whines of the poor dogs which now and then rise above the turmoil of the tempest. The pony stands in her blanket coat with her back humped up and turned towards the wind, the dogs have curled themselves up with their noses under their tails and are buried beneath the drift. So the

time slowly passes. I wrote the following record, after thawing out the little bottle of ink which Armitage held in his hand to keep fluid while I wrote, to leave with three visiting cards and a penny-piece wrapped in a Jack and placed inside a corked spirit tin in a small cairn on the top of the Cape, if I am able to get up there when the weather is better:

"THE JACKSON-HARMSWORTH POLAR EXPEDITION.

"Two members of the above Expedition reached this spot on March 28th, 1897, two weeks out from Cape Flora having been much delayed by bad weather. We make the position of this cape to be Lat. $80^{\circ} 56' N.$, Long: $50^{\circ} 47' E.$

"We intend to proceed in a W.S.W. direction round the land. All well.

(Signed) "A. B. ARMITAGE.
 "FREDERICK G. JACKSON,
 "Commanding the Expedition."

The bad weather continued through the day until evening when it began to clear up. I had examined the dogs when I turned out this morning, and found them buried in the drift, but apparently all right. The gale blew hard, and the snow drove fiercely before it, which with the very low temperature cut the small exposed portion of one's face around the eyes like a knife, and fairly blew through us. This afternoon I found poor "Pincher," one of the dogs, frozen as hard as a piece of rock and quite dead. He was fairly frozen to death. "Rags" had one leg frozen down into the ice, which we had to hack out with a small pick to release. Four dogs are off their feed.

We took the pony's snow boots off in the evening

as there is very little snow on the ice here. Her hind boots from moisture were hard frozen and had ice in them, and we had considerable difficulty in getting them off. The front ones were all right.

March 30th, Tuesday.—An improvement in the weather this morning. Having had breakfast I started off with my hand-camera, compass, and stand, the tin, flag and crowbar, to make a cairn and take bearings on the top of the cape, leaving Armitage to break up camp and pack up. I ascended the rocks by the ice-slope on the western side and made a cairn on the north-west side of the summit. I flew four flags and photographed them flying from the cairn. Left one of our small Jacks upon a seven-foot bamboo staff standing above the cairn, among the stones of which I deposited the tin containing the record, &c. Took a few bearings and made sketches of the coast-line within view. It was clear to the north-west (but misty otherwise), and I could see a polynia of water about ten miles away. None of the ice is heavy, but small broken, crushed-up stuff and no bergs. A few broken-up pieces of fresh-water ice and fjord ice without any heavy ice, suggest to my mind the possibility of land to the north-west,* although no sign of it is visible. There is a connected land-floe for at least six miles to seawards. The land to the south-west appears very low, and the coast of the curved bay named by me Crichton Somerville Bay,† running to the S.S.W. from the cape, is quite low and free of ice, as is also a peninsula forming the north-west coast of it. I estimate the height of the cape at five hundred feet. It consists of weathered columnar basalt. A few dovebies were on

* I think it probable the islands to the north and north-north-west hold a good land floe here.

† After Mr. D. M. M. Crichton Somerville.

the rocks and a considerable number of rotches. The summit consists of broken-up basalt overgrown in places by moss, so far as I could ascertain by digging. Lichens were on the rocks, and I found one saxifrage on the talus. I got my cheek a good deal frozen on the top, as a keen north-east wind with a temperature of 20° below zero was blowing there, and on my return to camp it was found to be quite white.

When I got back we had some food and made a start. Poor little "Joey" died soon after leaving. He had gradually grown weaker and weaker, and now could hardly totter along. We carried him on a sledge for some hours, as he walked badly, wrapped up as warmly as we could, but it was of no avail. He died on the sledge, and was frozen hard before we camped at night. Poor little chap! he was plucky and game to the end, but the cold and exposure were too much for him. This incessant bad weather is killing our animals, and all look weak and off colour. The pony has got very thin and goes badly, requiring incessant urging to keep up a slow walk. The north-east wind increased in force as the day went on, and when we encamped inside the north-west extreme of Crichton Somerville Bay it was blowing a strong wind with a temperature of 22° below zero, making it very cool and trying, freezing our noses and cheeks every few minutes, as our face-guards have got coated with ice and are frozen hard.

The low shores of the bay consist of basalt, and on the north-western side rise to about seventy-five feet with a flat surface after an abrupt rise from the sea. The wind increased to a gale as we pitched the tent for the night. There seems no end to this horrible weather or the inconveniences accompanying it. When sledging all food is frozen hard. The fried loom meat,

which we cut into small pieces ready for warming up when at the hut, now resembles marbles; butter is like stone and tests the strongest knife to make an impression upon it. Our furs are as stiff and hard as sheets of galvanised iron, and Armitage and I have sat for hours after a hard day's march, shivering in the tent trying to force our bodies into them by degrees, by sitting upon first one part of a "militza" and then another, and gradually working it with our hands into a more pliable condition. Such are some of the joys of sledging!

March 31st, Wednesday.—Blowing a gale from north-east, with dense, driving snow, snow falling, and it is bitterly cold. The temperature has fallen to 36° below zero during the night. All that can be done is to remain camped and try to keep ourselves warm. The tent, of course, is incessantly raining showers of snow from condensation down upon us, and our furs and all our gear from being very wet are frozen as stiff as steel, and are white with frost. It is a labour of hours to get into any of our fur clothes. A worse climate than this it is impossible to imagine. We are obliged to sit here in the utmost discomfort, eating our food and doing nothing for it, time is creeping on, and our animals are freezing outside in the blizzard.

This evening four of the dogs refused their food. All the animals will die if this kind of weather continues.

April 1st, Thursday.—The thermometer fell to 45° below zero during the night, but the wind has decreased in force and is now westerly, with overcast sky, dense mist, a fine snow falling, and the temperature is rising.

As it looks as if we had got into a *cul-de-sac* in this bay, I think it better to go round the low basaltic headland Cape Battenberg, which is eighty feet high and outside it, rather than sledge over the low land with

our weak animals, which may lead us into endless difficulties.

We packed up and started, meeting a keen, damp westerly wind, which, with a temperature of 22° below zero, is cool. We stopped at 2.30 P.M. for some food, and as the wind had increased from a fresh to a strong wind, with driving snow, we put up the tent for an hour, but to save time, without throwing up snow around it, to get some protection. Our faces raw, from frostbites and excessively sensitive, obliged us to constantly wear our masks; our hands too are in much the same condition.

We were very cold, as the biting wind fairly blew through us, and we should have become badly frost-bitten had we had food in the open. We look awful ruffians with our scrubby beards and frost-scarred faces. My wrists too are raw from the frozen cuffs of my jumper chafing them. They had only just healed from old frostbites, and I think our appearance would astonish our acquaintances could they see us. We often roar with laughter at each other, and wonder what some of our West End friends would think of us could they meet us in our present condition. Certainly we should create some amusement were we to appear in Piccadilly or the Park now.

After lunch we passed through very rough broken-up ice, with a number of small bergs amongst it, which give us much trouble. "Hyena" completely gave in and could not walk behind the sledge. As there is no chance of his recovering I put him out of his misery, poor beast. Three others will follow him unless they improve soon. The prospect isn't cheerful, and we shall be reduced soon at this rate to hauling as best we can the sledges ourselves, which will mean leaving both the canoes and most of our equipment behind. We proceeded as

best we could through the rough ice and dense mist in a W.S.W. direction to clear any outlying points of land, for we could see nothing ahead of us, and about 5 P.M. got on to sticky bay-ice and sighted open water. To avoid this I struck south-west and got upon older ice, and deep hollow snow, with only a surface-crust upon it. I had great trouble to get "Brownie" along at all, as she is weak and utterly played out, and the dogs are no better. It is miserable work getting along weak, tottering animals, but there is no help for it, for push on we must. When I stopped at 8 P.M. she threw herself down and refused to move until lifted on to her legs. The thermometer then stood at 30° below zero, with a fresh wind blowing. It took us hours to get into our furs in the evening, which, having got wet a week or two ago, are frozen as hard as rock. It is very trying weather for our poor animals; the wind goes through everything. We frequently speculate as to how far we have to go yet and how long they will last out.

Travelled in all about eight miles.

April 2nd, Friday.—I took bearings to fix our position as soon as I turned out as the mist has somewhat lifted. The thermometer registered 42° below zero during the night, and stands at 30° below now, with the sun well up. Proceeded in a south-western direction towards a distant point of land. Very misty towards the eastwards and cannot make out quite the contour of the coast there, chiefly owing to there being low land on this side of the higher country.

We have passed over ice varying in character greatly. Some consisting of crushed-up heavy oceanic ice deep with snow, and then coming upon thin crushed-up bay-floes with little snow upon them. A keen wind with the low temperature obliges us constantly to use our face-

masks. We stopped for lunch at 6 P.M., putting up the tent in a hasty temporary manner, and then continued our march until 9.40 P.M., when I could no longer see the point of land owing to mist and increasing darkness. The temperature then was 32° below zero, with a nasty wind. We are getting a little tired of these low temperatures with a high wind. It isn't a bit nice.

The animals went better to-day, and by breaking up the meat small with a tomahawk we induced "Smike," "Charles," and "Rags," the dogs which are in the worst condition, to eat a little.

Travelled south-west about seven miles. Our furs are in a fearful state of hardness and took us till 2 A.M. to thaw them sufficiently to get into them to-night.

We never walk in our furs, as one gets too warm in them, and the impervious skin shuts in the perspiration. The dress we have now adopted for marching I consider is difficult to improve upon. It consists of knee-breeches of warm cloth, a loose jumper of thick woollen stuff, and a close fitting-cap, wrapping close round the neck, ears, throat, and chin, and coming well round the face, across which is buttoned what is practically a cloth mask, leaving only apertures for the mouth and eyes. The whole dress is covered with a thin, light waterproof linen material, which stops the wind and prevents snow from sticking. It is the outcome of some years of practical experience, and I have altered, modified, and added to the dress until I have obtained what is, I believe, as near perfection as any dress can be in the Arctic, which is an exceedingly difficult part of the world to dress for—where too warm a dress is as bad as one not warm enough. Once get hot and perspiring and it takes hours before one feels dry again, and with the invariable accompaniment of feeling cold and getting chilled.

April 3rd, Saturday.—The thermometer had sunk to 46° degrees below zero, but when we turned out it had risen some degrees, with a W.S.W. wind, mist, and falling snow, but the temperature soon fell again. We packed up and started south-west towards a point across the large fjord—Mabel Bruce Fjord—which I believe connects with Chamberlain Fjord, and also curves round to the westward, over much broken-up but light ice with little snow upon it. As we pushed on the wind increased in force and was very trying, as we had to march straight in the teeth of it; the driving snow was blinding, and cut our eyes like shot.

We had much difficulty in putting up the tent temporarily for lunch, and after having had a pot of tea, some biscuit, cheese and bacon, we struggled on, hauling at the sledges and shouting at the animals, which stopped every few yards. The wind increased to a strong wind which rapidly became a fresh gale. We had lost sight of the land before lunch, and I directed my course by the wind, the dense, driving snow rendering it difficult even to see Armitage, who was following with the dog team. Once I lost sight of him as he had fallen behind, so I went back on my tracks as far as I dare go without losing sight of the pony and sledges and coo-o-o-ed and shouted, and there waited for him to come up, which he did after some time. The animals went badly, and it was with difficulty that they could be forced to face the wind and drift.

We struggled on until 11 P.M., when we absolutely could not see ten yards in any direction. The tent took us hours to put up in the blizzard, and was finally erected in a very lop-sided condition, but it was the best we could do; we were glad to get into anything in the way of shelter. It is a charming climate!

Travelled south-west about six miles.

April 4th, Sunday.—The gale dropped during the morning, the wind changed to W.N.W., and the sky cleared. Armitage took a meridian altitude, making the latitude $80^{\circ} 48' 46''$ N. (approximately). On the mist on the horizon lifting I took a round of angles and a few photographic negatives, and then started off in a W.S.W. direction towards the termination of the ice slope ahead. As we advanced low land in front of it opened up, and I gradually altered my course to get round it to nearly W.N.W. The characteristics of this northern coast are quite different from anything we have seen elsewhere in Franz Josef Land. Here the land is low, and the high basaltic headlands, so common elsewhere, are conspicuous by their absence.

Before stopping for lunch "Mick" entirely broke down, and we carried him upon a sledge, but before reaching our lunch camp the poor animal died, and we cut him up and fed the other dogs with him, as we are running very short of meat, all of which—"Räwing" excepted—ate all they could get. We then pushed on across fairly level floes with little snow upon them, until 11 P.M., when we reached the end of the long stony spit, where we camped. At 5 P.M. we stopped for a few minutes to take an observation for longitude. The dogs went very badly owing to their weak condition, and are now reduced to eight in number. The pony stepped out better. Her bowels are now getting into a more healthy condition.

There was a dense wet mist after 7 P.M., completely hiding the land. The thermometer was 12° below zero when we stopped. Wind (moderate) from west.

April 5th, Monday.—At 2 P.M. Armitage and I took observations for double altitude; and I then took two

sextant observations to mean with Armitage's, while he took the time for me.

I placed the following record in a tin together with three visiting cards, a penny-piece, and a Jack, and buried it in a cairn of stones upon the spot :—

“THE JACKSON-HARMSWORTH POLAR EXPEDITION.

“Two members of the above Expedition reached this spot April 4th, 1897, having travelled up the British Channel and round the north-east point of the land.

“We have experienced very severe weather, and this has reduced our number of dogs from twelve to eight which are very weak.

(Sig.) “A. B. ARMITAGE.

“FREDERICK G. JACKSON,

“Commanding the Expedition.

“April 5th, 1897.”

I feel very sure from the character of the ice off here that the set of it is off-shore, and that strong northerly winds are not the rule, or else there is land to the north-west, which protects the ice here. We can, however, see none.

Several flocks of rotches were noticed yesterday and to-day, and three looms flying west ; they were, however, very distant. I took bearings of all land visible and made sketches. I also took several photographic views of the cairn and camp. The cairn is made of large jagged basaltic boulders upon a slight rise of the low stony spit, and should always be a prominent and easily-seen object. It is about three feet six inches high. At 5 P.M. we took the second observation for double altitude and sun's bearing for declination.

We then packed up and started, but it had quickly become overcast, with a dense mist from south-east and

wind, which rapidly increased to a fresh gale with heavy snow.

We pushed on with great difficulty and without being able to see anything clearly beyond the points of our ski. Armitage and his dog team twenty yards behind me were frequently almost hidden from sight, and occasionally completely. The dogs went very badly, occasioning constant stoppages and hauling up of the sledges. I went on steering by the wind until 10 P.M., when, coming across a boulder of basalt, rounded off as if by water, I decided to camp, as we were doing little good owing to the difficulty of keeping a course, and were wearing the animals out. They would not face W.S.W. at all, the direction of our course, as the wind met them sideways, and they would turn their backs upon it, in spite of all we might do to prevent them. I therefore kept more westerly.

We put the tent up in the howling gale and snow with great difficulty, going through quite a chapter of accidents in doing so, and feeling very out of temper at things in general. This is a climate indeed!

The dearth of draught animals has contributed greatly to our difficulties on this journey. We shall be lucky to get back with any of our animals alive, and without leaving behind a great part of our equipment.

The temperature rose to $+5^{\circ}$ during the south-east gale, but the wind changing to west during the night, it fell again to thirteen degrees below zero.

This low land on the north-west coast is remarkable, and renders it rather difficult to pick a way. I have seen no glaciers that reach the sea since leaving the British Channel.

April 6th, Tuesday.—Poor "Charles" this afternoon

ended his days, and I had to convert him into dog meat. Last night's storm practically finished him. Seeing our animals die in this manner is sad work. The thermometer had fallen again to 19° below zero when we turned out.

We started over the low flat country in a W.S.W. direction. It is nearly level, but with slight eminences of broken-up basalt here and there, caused I believe by ice. The dogs went badly owing to reduced numbers, and "Misere" and "Pongo" broke down. On stopping at 9.20 P.M. I gave them both a little whisky, wrapped them up in empty vegetable bags, as the thermometer stood at 30° below zero, and they at once dropped off to sleep.

What looks like the head of a bay shows up a little to the east of south of us, but it is too misty in that direction to get a clear view, or be sure of anything.

We travelled W.S.W., about six miles. I had an accident with my watch to-day, letting it fall owing to hard frozen icy mitts and it has stopped. Armitage lost a compass off the sledge. Misfortunes never come singly!

April 7th, Wednesday.—The day opened sunny and clear. To my great surprise the bay to the south by east of us leads out to the southward. It must be Cambridge Bay which reaches much further north than we supposed in July 1895, and does not run out in the manner I then supposed. I took a photo of the head of the bay and camp.

"Pongo" and "Misere" died early this morning. I am particularly sorry about poor little "Pongo"; he was one of my own dogs, was always plucky, and always willing. He hauled gamely right up to the finish. He was one of "Jennie's" pups, and was a favourite of mine owing to his resemblance to her. We have now only

five dogs left. I skinned and cut up the dead ones for dog food, for we cannot afford to waste meat. We took observations for double altitude.

I then went off on ski, taking my hand-camera to satisfy all possible doubts as to the ice which lay before me being

A CAMP ON THE SHORES OF THE QUEEN VICTORIA SEA

salt, and not that of a lake, by examining the tide cracks. After going a couple of miles I came upon the shore of the bay with numerous tide cracks, and also bergs lying off the north-eastern shore at the foot of the ice slope. I took several negatives of the glacier slope and head of the bay. Armitage had in the meantime been engaged in packing up. I hurried up my return to camp, as it was rapidly becoming overcast and misty, and heavy clouds were coming up fast from the south-east. I wished the second observation for double altitude to be

taken before the weather rendered it out of the question. We did this immediately I got back to camp.

The bearing of the direction of the bay from our camp on the north-west side of it (distant two miles from the shore) was 158° (magnetic), and I could see nothing but sea ice at the southern end. On either side moderately high glacier slopes bounded its shores which appeared to rise to from about five to nine hundred feet high.

After having some lunch of tea, biscuit, bacon, and cheese, we started off in a W.S.W. direction. A thick mist had come up with a south-east wind with a temperature of 25° below zero, and the weather looked very threatening.

The dogs pulled well but slowly, as the poor brutes are greatly overweighted now owing to our losses. I relieved them of as much extra weight as possible, adding some of their load to the pony's. They and "Brownie" look wretchedly thin and weak. They are, however, struggling pluckily along.

We passed over a low undulating country of broken up basalt, with slight rises here and there, but deeply covered with snow. It reminds me occasionally very much of the tundra of Waigatz and North-east Russia.

We went on until 9.55 P.M., when, as I then came upon a suitable boulder to tie the pony up to, and the weather was rapidly getting worse, so that we could see absolutely nothing around us but a dim, very circumscribed, misty, white circle, I decided to camp. The wind had increased to a gale from south-east, with falling and driving snow, and the thermometer had risen to zero.

We travelled W.S.W. about six miles. None but those who have experienced it know what excessive labour

and trial of temper it costs to cover every single mile in this country under our circumstances. There is every indication on the sky of open water to the W.S.W. and W.

I am inclined to believe that Cambridge Bay runs out at the north-east corner.

April 8th, Thursday.—Blew hard all night, but lulled somewhat in the morning, and we hoped it was over. I started to take a meridian altitude of the sun for latitude, but it rapidly clouded over again, and the wind increased to a strong gale, which shook our tent violently and threatened to carry it bodily away. The temperature at 10 A.M. had risen to $+ 24^{\circ}$ (a rise of sixty degrees in twenty-four hours). We shall have to wait until the weather improves, and another bad-weather camp is our lot. We mended mitts and made necessary repairs to our equipment. Armitage worked out yesterday's observation for double altitude, which places us to the north of Cambridge Bay. The gale continued with snow throughout the day, but the mist cleared a trifle about 8 P.M., and the wind fell. The thermometer stood at from $+ 14^{\circ}$ to 21° throughout the day, and everything in the tent is now moist and wet. Our furs are beginning to smell and go rotten. These great fluctuations of temperature are very troublesome. By-and-by the thermometer will fall again, and the frozen hardness of our garments will be worse than ever.

April 9th, Friday.—Overcast, misty and still warm (temperature through night, minimum -9° below zero and maximum $+ 22^{\circ}$).

The wind woke up again and blew from a moderate to a fresh gale with frequent storms of heavy snow.

We started off in W.S.W. direction over the stony flats to round the glacier slope. I found three pieces of

driftwood about half a mile from the sea and at an elevation of fifty feet above the present sea-level, from which I cut specimens.* At 7 P.M. after travelling about ten miles I reached the top of a slope covered with boulders about eighty feet above the sea, where the low land terminates abruptly, and glacier face again begins. To our disgust I found open water stretching right up to the glacier face, and if we are to proceed in a south-west direction will force us to take to the glacier and climb the steep icy country to get on. The dog-team with Armitage was in difficulties about a mile behind, so I took out the pony leaving the sledges upon the top of the rise and returning to him gave the dogs a help on with the pony. I decided to camp to give the mist a chance of lifting and to enable me to have a look round, and see the best direction to take.

Armitage tells me he believes he saw a glacier and rock bearing $304\frac{1}{2}^{\circ}$ from our morning's camp through the mist, but when I came out of the tent to look at it the horizon had misted over still more and did not even partially clear again. I feel sure he is mistaken or we could not have failed to have seen it before.†

Travelled W.S.W. about eight miles.

April 10th, Saturday.—Still warm (maximum $+29^{\circ}$ minimum $+22^{\circ}$ during the night) temperature at 9 A.M. $+27^{\circ}$, overcast and very misty, and we can see nothing in any direction. I named this spot Cape Nimrod after the London club under the hospitable roof of which I have spent many pleasant hours and where I have met with very much kindness. I made out at least four

* On examination under the microscope three species of diatoms (a new worm), four algæ, a snow-flea, and water-bear (*tardigrada*) were found.

† In this Mr. Armitage afterwards agreed with me.

distinct raised beaches upon Cape Nimrod, the highest being about eighty feet above the present level of the sea.

I placed a Jack upon a seven-foot bamboo staff among the boulders on the seaward side of the rise close to our camp and among the stones at the foot of it I placed in a spirit tin, a penny, three calling cards, and the following record partly in pencil—

“THE JACKSON-HARMSWORTH POLAR EXPEDITION.

“Two members of the above Expedition reached this spot April 9th, 1897.

“We have met with open water reaching up to the glacier face from out to seaward. We have here to travel over the glacier to avoid it.”

“Cape Flora.

(Sig.), “A. B. ARMITAGE.

“FREDERICK G. JACKSON,

“Commanding the Expedition.

“April 10th, 1897.”

I took several negatives of the camp and surroundings, and then started off in a S.S.W. direction obliquely up the glacier slope.

This gave us very hard work as the incline is at an angle of about 15° .

Armitage and I both put on our harness and hauled with the animals ; but I soon found that we could only get on by attaching the five dogs and pony to one set of sledges and then after taking them up some distance return for the others. The animals stopped every five yards and we had the greatest labour to get them on at all, and it was only by the most strenuous exertions that we did so. I led in the traces in front of the animals, and Armitage tried hauling himself, but soon found that

this did not answer, as they took advantage of his occupation to slacken off and he had to devote all his attention to urging them on. It was only by incessant shouting and pulling up of the sledges that they could be moved on at all. However, after reaching a height of about seven hundred feet, the slope became more

OUR CAMP ON CAPE NIMROD

gradual and we got on better. On stopping for food at about eight hundred feet above sea level we got clear of the mist which lay below us like a dense white billowy blanket. We estimate that we had come about two miles.

The surface of the glacier was somewhat rough, the compact snow upon it being much cut by the wind into deep furrows and ridges, but had the appearance of being free from crevasses, but being aware of the treacherous nature of such glaciers I felt anything but comfortable. We could however only push on and trust to Providence,

as there was absolutely no indication on the surface to point out the yawning chasms that might lie beneath our feet.

We started off again on the same course and had gone about three miles further when suddenly without any warning or any indication on the surface to show its presence, the pony dropped all four legs into a crevasse and lay suspended over a deep black abyss upon a bridge of snow. Fortunately she was too frightened to struggle, or both she and the sledges would have disappeared. I at once passed the reins round her neck and tried to hold her up. Armitage seeing what had happened promptly came to my assistance, but unwisely stepping off his ski sank into the crevasse up to his arms. I must confess that the next few moments were anxious ones as I endeavoured to hold up the pony with one hand and to render assistance to Armitage with the other. He remained perfectly cool and collected, and fortunately managed to scramble out into safety. I then passed a line round the pony's neck and we succeeded after much pulling and hauling in extricating her from her perilous position. We got the sledge over and then put the pony into the harness again. We had not proceeded a hundred yards further before she dropped her hind legs into another yawning chasm, the black depths of which one could not fathom, but I got her clear without help. There is absolutely nothing on the surface to indicate these crevasses, not even a slight depression in the snow which is sometimes the case, and even when one is made aware of their presence there is nothing to indicate the direction they take. Ski are a great protection when travelling over such glaciers. We laughed over the incident a few minutes afterwards, but at the time it was anything but pleasant, and we pushed on

feeling that the next step might send us plunging down through the glacier hundreds of feet below, which would be a very effectual burial indeed.

A strong wind from south-east with driving snow shortly afterwards came on but died down just before we camped at 9.10 P.M. I sounded all round our camp for crevasses with my ski stick before pitching our tent, and arranged with Armitage not to go outside certain boundaries.

A moderate gale from south-east got up soon after we had pitched our camp, which increased in force as the night advanced. I secured the pony to a chain stretched on the snow between two sledges, and secured in the centre with our small crowbar driven into the snow.

It seems to be constantly blowing from the south-east towards the glaciated land from the open water off the coast and back again. There is open water both north and south of us doubtless. The glimpse I had of the Queen Victoria Sea at our camp to-night showed it to be very open indeed with only light broken up ice to be seen in it, and reaching as far as we could see to the west and north-west.

The temperature as we ascended fell from $+27^{\circ}$ at our morning's camp to $+7^{\circ}$ when we camped at 9.20 P.M., and still lower as the night advanced.

Travelled S.S.W. about seven miles.

April 11th, Sunday.—It has been blowing a strong gale all night from south-east and when I turned out this morning it was still keeping up this force with snow and a blinding drift of fine powdery snow cutting off all view at a radius of ten yards distant. Our sledges are buried out of sight and everything looks the reverse of pleasant. We cannot travel in this weather as the animals won't face it, and also it is useless to wander about in the semi-

darkness of a blinding snow-drift and blizzard. The incline ahead of us and the pressure of wind against us, would effectually anchor us even if the animals would attempt to pull, which they won't. We must camp until it improves, however irksome it may be. The gale continued throughout the day, increasing in force to a full gale at intervals and rattling and banging the tent about in a very ominous manner, but fortunately it stood up against it. We sat in the tent trying to keep the cold out as best we could, and endeavouring to repair our now dilapidated mitts, and put our gear to rights generally, only going outside to feed the animals and to do things absolutely necessary.

We are a month out to-day.

April 12th, Monday.—It blew and snowed hard all night but lulled early this morning, the wind backing to a fresh wind from the west with a temperature of $+ 29^{\circ}$ and thick snow falling and dense mist. Our furs are very wet, the hair is coming off them, and an intolerable stench fills the tent, as a result of the high temperature now prevailing, a fall of the thermometer will come shortly, and they will be as hard and unpliable as steel again and worse than ever. The barometer is very low (28.38) and won't rise, so we are expecting a renewal of the gale every minute. Anxious as I am to get on I shall wait a time and see what it means to do. I am much afraid of running out of food for the pony by exceeding our rationed time, and we do not know yet the length of the journey in front of us. The bad weather continued throughout the day and from a strong wind with driving and falling snow it woke up again to a fresh gale towards night.

The pony has got very weak and this vile weather will finish her. After we had turned in at night I heard her

making attempts to get on her feet. As this continued without her doing so, I went out to help her, and soon afterwards was joined by Armitage. We tried for an

DEAD-PONY CAMP

hour in the howling gale and fiercely driving snow to get her on to her legs, but she was too weak to stand, and we were forced to leave her after covering her up as warmly as we could in her blanket coat, and giving her

the last of the oats which I had been reserving. Poor animal, it's all up with her. If I had had proper food for her I should have got her back all right. Oats and vegetables answer very well together, but dog biscuits and vegetables are quite insufficient, and liable to cause derangement of the bowels as in her case, for both absorb water.

"POOR 'BROWNIE' LAY DEAD THIS MORNING"

April 13th, Tuesday.—Poor "Brownie" lay dead this morning. She deserved a better fate than to leave her bones upon this dismal silent glacier. She has been a good, faithful, and useful servant to us and had become quite one of the family. I feel very sad about her. I had been promising her all sorts of good times if I could only get her back to London. No more work, but luxury for the rest of her days.

I am afraid it was a very depressed couple that sat in the tent this morning, which is not often the case, but I must admit that I do feel very melancholy about poor "Brownie," and feel her death keenly. With her, too, dies more than half our draught-power, which is a

serious matter. The fact of having kept her alive on the 80° of north latitude for 2½ years, a great portion of which time she had not ordinary horse food, shows that my idea of taking ponies was correct. That horses can live in an arctic climate and be of use I think I have now proved.

I got a bit of a chill the day before yesterday and have a pain in my right side and feel distinctly seedy. The weather has improved, and the barometer has gone up a good deal during the night, but the mist is as dense as a hedge.

We shall now have to reduce our weights to the very lowest limits, and discard everything not absolutely essential to life and scientific work. Armitage and I set to work as soon as we had had breakfast to dig the sledges out of the drifts. This, as we have broken the little shovel and have only the blade left, was no easy matter, as the snow was packed hard, showing only a part of the bags on the very top of the sledges. I discarded three sledges and every article of our equipment we could dispense with, and after I had photographed this wretched camp we loaded up three sledges. It is a sad time for us thus to see our animals die one after the other, to say nothing of the loss of draught-power which renders progress at all very difficult, and we cannot even guess at the length of the journey in front of us. We have set out to go round this western land and mean to accomplish it somehow. We started S.S.W. with the three sledges. We soon found that we could not get along at all as the team of five dogs did not move a hundred yards in half an hour. We then unpacked the third sledge and placed its load upon the sledges with the two canoes upon them, and took on each sledge about a mile and then returned for the other. I hauled in front of

the leading dogs for them to follow me and to steer a course, while Armitage hustled them up, and, by incessant shouting and tugging at the sledges whenever they stopped, which they did every fifteen or twenty yards or so, started them again. I believe his work was the harder of the two, at all events it was the most irritating. They took advantage of Armitage if he pulled also, so he let go his trace.

Just before we started about 2 P.M. the horizon cleared, showing no land visible either to the west, north-west, or north. Our altitude was 1200 ft. above the sea, and gave us a good view over the Queen Victoria Sea in these directions. Where is Gillis Land?

A strong wind from south-east sprang up with driving snow, making hauling against it, in addition to the incline, very hard work. We went about two miles and a half, rising one hundred and twenty feet more, going thrice over the ground; when as the weather grew worse I decided to camp at 8.40 P.M. The wind soon increased to a gale. What a climate!

This south-east wind seems nearly continuous here and is accompanied by a rise of temperature, resembling the fohn winds of the Greenland west coast. It began to snow heavily. I rigged a sledge sail as shelter for the dogs, but in the most perverse manner they immediately lay down upon the top of it and caused it to be immovably frozen into the snow and ice of the glacier.

Travelled S.S.W. two and half miles.

April 14th, Wednesday.—Blowing hard and snowing all night, and this morning it hasn't improved in the least, the barometer is falling. We spent the day in repairing our gear and in smoking. Nothing can be more trying than this life of inaction when we are anxious to get on with our work, or the dreariness of delay, the

weariness of doing nothing, especially when valuable time is spent in considerable physical discomfort. The wind blew from a moderate to a fresh gale throughout the day from south-east, with dense falling and driving snow and mist.

Our extreme view is bounded by ten yards from the camp, and even the snow beneath our feet can only be indistinctly seen owing to the dense white mist.

The thermometer is now falling.

April 15th, Thursday.—Blowing hard all night. This morning the wind showed signs of decreasing and changed to south, but veering to W.N.W. it woke up and blew a gale again. The barometer is however rising slowly so we are hoping for something better.

We spent the day in darning mitts and socks with string—we have no other darning cotton—and in repairing our gear generally. Towards evening the gale died down and the sky cleared, we then set to work to dig the sledges out of the drifts and straighten things up generally. I repaired the fastenings of my ski, which had worn through.

The thermometer at 9 P.M. had sunk to 4° below zero from +25° F. at 10 A.M. These fluctuations of temperature are very troublesome. The warmth reducing our clothes, fur boots and gear to a state of moisture, and then a fall of the thermometer comes and everything becomes of a steely hardness, rendering it a labour of hours to get into our fur jumpers and boots, and making our equipment very unpliable and difficult to handle. Our under-clothes are reeking with damp when sitting in the tent with our furs on, which when we go outside at once become frozen and rigid. We try to dry our socks and mitts every night by placing them upon our chests, but this process is only partially effective and

is not a very comfortable one. However, it is the only means we have, although we occasionally use a little of our precious spirit to extract some of the moisture from them over the lamp. This usually ends in holes being burnt, and more darning with string is then necessary.

April 16th, Friday.—Turned out at 6 A.M. to get an early start. It is still fine but looks very threatening with a south-east breeze and dark clouds in that direction.

I got a clear view from west through north to north-east over the Queen Victoria Sea, and see no land at all in any direction off shore. We are now at an altitude of nearly 1500 ft. above the sea. Where is Gillis Land?—it cannot exist. What a part of the world it is for "Fly-away Lands!"

We started off in a south-west direction, I taking the lead in the traces in front of the dogs, going about three miles, when Nordenskjöld Bay I believe, came in view, but it was very misty. The labour was excessive and it was only by straining every muscle to the utmost that we could get along at all, even by going three times over the ground and taking on a single sledge at a time and then returning for the other one and the nearly empty third sledge. This being entirely undiscovered country, an unknown land, with the dense mist cutting off the view at twenty paces distant, the difficulty of steering a course was great, and every few minutes I had to stop, take out my compass, and correct our direction. Seeing that we had struck the north-east corner of the bay with either boulders or broken up glacier ice below us, I turned due west to reach Cape Mary Harmsworth, from which I hoped to get a view of any land to the west of it or off the southern shore. For a little distance, aided by the slight downward incline, we got along with the two loaded and one nearly empty sledges together; but after

stopping for food the snow became so very deep and soft, that in spite of our most strenuous exertions the dogs and ourselves could not move the sledges more than five or ten yards without stopping, and then it took us three or four pullings up of the sledges to start them on again. The dogs are played out and "Bismarck" the leader, especially goes very groggily.

On finishing lunch at 2 P.M. we found the mist denser than ever, and a fresh breeze from south-east changing to south sprang up with fine falling snow. We pushed on in semi-darkness until 5 P.M., when, the wind increasing and the snow driving, I considered it advisable to camp out of consideration for our tired dogs and the fact that another gale was evidently imminent.

We came three miles south-west and about four miles west.

I hauled all day, and Armitage whipped up the dogs and pulled up the sledges when stoppages occurred, which were incessant. We both had a hard day.

April 17th, Saturday.—It blew a strong gale through the night with heavy falling snow. Our furs are all in an awfully wet and rotting condition and smell horribly. The inside of our tent and ourselves are moist in the extreme. The temperature at 8 A.M. was $+22^{\circ}$ rising to $+29^{\circ}$ by 11 A.M. A dense wet mist cuts off all view at a distance of twenty yards, but the wind has dropped.

We are giving our dogs extra food, trusting to killing a bear. Our food we are economising to the utmost extent, as we have only one week's rations and a little we have been enabled to save left, and we do not yet know how long we may be out, or where we shall be able to obtain more.

The dense mist continued throughout the whole day, and nothing whatever could be seen at more than ten

yards distant. A thick frost-rime forms upon everything, coating our clothes and equipment with ice, and the snow is very deep and soft.

There was little to direct our course by, to-day, as it was quite calm and no sun was visible. I was obliged to steer by the direction of the sastrugi cut by the south-east gale, taking them obliquely and so travelling west. I would get off this horrible glacier, where we are wrapped in the perpetual semi-darkness of dense mist and snow, if I could, which, together with the incessant gales and driving snow, renders it a perfect Arctic inferno, and travel on the sea ice below if there is firm ice there to travel upon. There may be less mist there, but it is impossible to find a way down the steep slopes until we can see a few yards in front of us. The barometer has been falling steadily all day. We went two and a half miles before stopping for food and a short rest, going three times over the ground, I as usual hauled in front of the dogs and Armitage whipped them up. We passed over several ugly crevasses, which were only discovered by a ski stick being thrust into the snow, when it suddenly dropped, and would have disappeared altogether had we let go of it.

After lunch we went on again in the same dense wet mist for a mile and a half, but being afraid of going too far, and of falling over the glacier face into the sea, before we saw it, I decided to camp at 6.40 P.M. and to wait for it to clear a little.

Travelled west four miles.

April 18th, Sunday.—It has been snowing heavily all night and is still as thick as ever this morning. The barometer however is slowly rising so we hope for a better state of things. We have been out five weeks to-day.

About 2 P.M. the wind became northerly and the mist became a trifle less dense. We spent the morning in cutting off the feet of our fur boots and skin stockings, which are soaking wet and rotten, and smell like a neglected slaughter-house, and in trying to repair them.

I wrote out the following record to place on the cape to the south of us, and enclosed it in a spirit tin together with a Jack, a penny-piece and four visiting cards :

(Copy)

"THE JACKSON-HARMSWORTH POLAR EXPEDITION.

"Two members of the above Expedition arrived at this spot on April 17th, 1897, having taken a week to cross the Worcester glacier through bad weather and loss of our animals. We have now five dogs only left, our pony having died on the 12th inst.

"We are now returning to Cape Flora by way of Cape Neale. We have mapped in the whole of the northern coast.

(Signed)

"A. B. ARMITAGE.

"FREDERICK G. JACKSON,

"Commanding the Expedition."

About 10.30 P.M. I turned out in the hopes of it being clear. I found that the mist had partly lifted, showing that we had passed to the north of the cape which now lies about due south of us. The sea runs right round Cape Mary Harmsworth, which is the most western point of Franz Joseph Land.

Looking out to the seaward I can see no indication of land in any direction and the broken up character of the ice is very much against the probability of there being any.

The dense black mist which lies lower down the glacier slopes below us is like the smoke from a million chimneys, only denser.

CHAPTER XXIX

WATER, WATER EVERYWHERE

April 19th, 1896, Monday.—The mist has again come up as bad as ever this morning, but with the partial glimpse I got last night we can move south towards Cape Mary Harmsworth. This cape is a veritable “old man of the sea”!

The barometer has somewhat risen, and the wind is north-east, which shows signs of increasing. We packed up and started down the incline due south, the dogs drawing the two sledges and a nearly empty one behind, with my help in the traces, at a good three miles an hour. At first the sun showed dimly through the dense mist, but it became totally blotted out soon after starting, and we travelled in semi-darkness, our horizon being a dim, misty circle with a radius of not more than ten yards; and sometimes the mist was so dense that we could barely see beyond the points of our ski distinctly. This condition of things in a totally unknown land, with the possibility of dropping into concealed crevasses at every step, which means certain death, and the difficulty of keeping upon any direct course, was not the height of joy.

I then had to direct our way by the wind, which had become south-easterly, and by the faint sastrugi cut by a south-westerly breeze a day or two before, which was probably quite local.

After going south about five miles we could dimly discern a dark circle, which might be the edge of a

glacier face, and, leaving the sledges to await my return, I ran down on my ski to investigate it as I was anxious to get off the glaciated country, which has given us such a bad time, on to sea-ice again if possible. I rushed down the steep incline towards the indefinite something we had seen from above, when, to my surprise, I nearly ran into the open water of the sea, which I found quite broken up and full of a mixture of detached lumps and thin bay ice. I just stopped myself going over the ice-precipice into the sea by slewing round in time, as the very thick mist prevented my seeing what the something was until I was right upon it. We had just passed several nasty crevasses, all concealed, one being only discovered by Armitage's seven-foot ski-stick suddenly sinking in up to the top on his driving it by chance into the snow. There was nothing for it but to keep along the glacier face and risk the crevasses, which we could not see. The mist was so dense that nothing beyond three yards distant could be made out, and the frost rime covered us and all our belongings with half an inch of ice, making our clothes like sheets of steel, and the frozen edges of our woollen jumpers have, by chafing, cut our wrists and necks and made them very sore.

To skirt the glacier face we had again to go up the slope, necessitating taking on single sledges with great labour, and retracing our steps. We went so about a mile and a half south-east. The wind then failed us; there were no sastrugi; the sun was not to be seen, and the mist as dense and wet as ever. I noticed a remarkable thing in reference to the moisture in the air, that although the thermometer was considerably below freezing-point, it did not become changed into ice until it came in contact with something, such as our clothes or equipment.

There was absolutely nothing to guide us, our course being wrapped up in a dense blanket of mist ; and to get on at all I had to stop and take out my compass every few minutes and correct our course, causing much delay. It is a remarkable thing that, without some object to walk towards or to guide him, a man has a tendency to walk in a circle ; and this we frequently experienced when shrouded in mist, with neither wind nor sun or marks on the snow to help us. After going once about half a mile and returning for the other sledge, to our disgust we found we had nearly gone round in a circle, and on looking at the compass found we were heading north-west instead of south-east. The whereabouts of Cape Lofley is very much puzzling us, for if the bay we had dimly seen a day or two ago was Nordenskjold Bay we should have come across it.*

We now very cautiously proceeded a little north of east about five miles, keeping along the slope of the glacier, and going a little down the incline again, when seeing what appeared to be the edge of the glacier, I rushed off on my ski down the steep slope to see if it was so, and if there was sea-ice we could travel upon. I had not gone far before I found a wide, open crevasse lying before me, which I saw just in time to stop myself running into ; so I slewed up and took the slope in a slanting direction towards what I could now see was Weyprecht Bay, with apparently sound ice up in its throat, but with water and broken up ice, and rotches and looms flying over it a little way out to seaward. I then returned to the sledges, and we started off down the slope after I had placed breaks upon the runners. The dogs, however, appeared to get frightened at the steep slope, and only would pull by fits and starts, causing

* We afterwards found that it was lying beneath us concealed by mist.

repeated capsizes and giving us a very tiresome time. We would start the dogs and on would rush the sledges, almost without any help, when the dogs, utterly dumb-founded at such an abnormal condition of things as sledges moving by themselves, would stand still to gaze in astonishment at the easily gliding vehicles and dodge on one side to allow them to pass, expecting to be run over. This would pull them up with a round turn, and over they would go, followed by howls from the frightened animals and, I am afraid, unparliamentary English from ourselves. Then upon being urged on they would start again, and the performance would be repeated, followed by another upset and further labour for us to get the overturned sledges upon their runners again, traces disentangled, and our gear replaced.

After trying this method for some time, and finding that we could not get on, we took the dogs out, and I taking one sledge and Armitage the other, we got them down to the glacier edge ourselves after many adversities, where, as it was now nearly 8 P.M., I decided to camp. The snow is very soft and deep, and without ski we sink above our knees at every step.

The aneroid indicates that altogether we have ascended 1450 ft., and the last slope was 700 ft.

At sea level we find far less mist, and bearing south-east from us across the bay is Cape Ludlow, and to the south is Cape Lofley on the other side.

We have now the satisfaction of knowing that we have rounded the extreme of western Franz Josef Land, and that Gillis Land, unless it be a small island far to the north-west does not exist at all. At all events, I feel sure that there is no such land in the position assigned to it upon the maps, or we must have seen it. The character of the sea-ice off the land in itself

renders it improbable. Thus our explorations entirely upset existing maps, and our route towards the Pole as planned by land has been frustrated by the non-existence of it.

It is with heartfelt joy that we find ourselves off that horrible glaciated country, with its perpetual mists, howling blizzards, and incessant snowfall. We feel as if we had been living in a bad nightmare, from which we have just awakened, to find ourselves in a clearer atmosphere, where travelling is easier, and crevasses and steep glacier slopes have been left behind, but our poor old pony and most of our faithful dogs have found their rest in that icy wilderness to the north.

April 20th, Tuesday.—The morning opened sunny and far less misty. A little east of south Cape Crowther shows up (bearing magnetic $138\frac{1}{2}^{\circ}$), and Cape Neale a little more to the northward (magnetic 134°).

We in July, 1895, a little over-estimated the distance between Capes Ludlow and Lofley. Weyprecht Bay is about eight miles wide towards the head, surrounded by high glacier with a rugged face and small bergs at its head and sides, and at either side of the entrance a ledge of basaltic rock projects from the ice cap. It is about eight miles deep.

I took bearings and made sketches, and also exposed several negatives. Just before we left, Armitage got a meridian altitude of the sun for latitude, which with the bearings I have taken will give us our longitude.

We then started off taking on a single sledge at a time, after a capsize of one of the sledges in going over the glacier face on the snow drift. The snow is excessively deep and soft, and the sledge with the canvas canoe upon it gets quite buried at times. I went into the traces as usual. Armitage is anxious to take his turn

at hauling, but he is such a good hand with the dogs that he cannot do better than where he is.

After going about a mile we got into very heavy, broken-up, trappy ice, with deep snow filling up the holes, into which a man without ski sinks to his hips. We had frequent upsets of the sledges due to their being somewhat top-heavy, and through the numerous concealed pinnacles of ice catching the runners; we had a heavy time generally. Our utmost exertions are incessantly required, otherwise the dogs at once stop, and it takes a vast amount of urging and hauling to get the sledge to move on again. We stopped for lunch at 4.15 P.M. of tea, biscuit, and bacon, and then on we went again. It became quite overcast and very misty, and put out of the question the observation for longitude we hoped to get. We struggled along under great difficulties until 9 P.M., when we camped.

We have been for some days on half rations of many articles to enable us to economise our food.

The wind (force 4) has been from the south all day with the thermometer showing twelve degrees of frost, but the air has been raw and moist, giving the feeling of being much colder.

I shall have to leave the canvas canoe, for we cannot get on at this pace at all. We have only five dogs now, and they are as weak as rats. We are short of food, and are overweighted. So after all our labour in its manufacture and in dragging it so far the new canoe must be sacrificed; I hope we may not experience the want of it.

We accomplished about four miles south-east by south (true), having travelled twelve miles to do this.

The latitude of yesterday morning's camp is $80^{\circ} 29' 50''$ N. (roughly).

April 21st, Wednesday.—Overcast, misty, and snowing. After taking everything out of the canoe, we left her standing upon her sledge upon the floe, and packed everything upon the other two sledges.

I left a notice in the canoe tied with string to one of her ribs, with a request to forward it to Mr. A. C. Harmsworth, London, when a reward will be given, as I think she has a slight chance of drifting out of the ice to the south, and of being picked up.

We started off with the only two remaining sledges, but soon found that we could only go ahead with single ones as the ice was fearfully tumbled about, the snow between the hummocks very deep, and with absolutely no crust at all upon it. Then we plodded on by going three times over the ground, and even then with constant stoppages and incessant labour. We then got out upon leveller ice, but only to find that it was very boggy. We crossed an open crack about thirteen feet wide, partly bridged with thin bay ice and a snow drift, and seeing that the open water ran right up to Cape Ludlow ahead of us and water washed the ice precipices fronting it, I struck east to again take to the glacier to push on, where the joys of sledging upon it will begin again, but it can't be helped. I went on towards the Cape as far as I could by myself, leaving Armitage with the sledges, to see if by any chance we could squeeze round, but the crushed-up mixture of slushy snow and thin ice gave way with me, and in I went, much to my disgust, for wet clothes are not amusing in this climate, especially when one has no fire to dry them.

I had considerable difficulty in getting out with ski on, but fortunately they also aided in keeping me up in the slushy ice and water, and aided by my ski stick I

clambered out. This quite satisfied me that we could not get them round the front of the Cape. I then returned to them, and proceeded north-east along the glacier-face which is about forty feet high here, to find a place where a drift would enable us to get up it. This we found after going about a mile and a half, and Armitage and I by great exertions managed to haul up the sledges by means of a purchase round the little crow-bar. The glacier face somewhat overhangs at this point. Having had some food we again proceeded south-east up the steep rise of the glacier with single sledges as before, it being just as much as the dogs and ourselves could do to move them on at all.

Snow was falling thickly with a south-east wind directly facing us, which made the going still harder; the mist also had become very dense. In this manner we proceeded until 10 P.M., when as the dogs were utterly exhausted, we had to stop. We camped upon the sloping edge of the glacier upon the western side of Cape Ludlow. Climbing these glaciers with sledges is killing work.

Travelled south-east-by-south about one and a-half miles, east about one mile, north-east about one mile, south-east one mile.

April 22nd, Thursday.—Blowing strongly from south-east, with falling and driving snow, and as dense a mist as we have met with. Although we are only about four hundred feet up the glacier, frost-rime is again coating everything two or three inches in depth with ice. It is useless to try and go ahead in the dead blank of mist, which cuts off all view beyond ten yards, and by travelling in it we should take a very erratic course, tire out the dogs, and stand a good chance of going over the glacier-face into the sea.

We spent the day in repairing our gear. I darned my mitts with twine, as I have nothing better, and repaired my boots. We also dried some used tea-leaves to smoke. It is not quite satisfactory, and is a poor substitute for tobacco. Anyhow, it is warm, and the mere spark in the bowl has a cheering effect, but we cannot say that it is a good substitute. Still men hard pushed will resort to anything, and accept every little change as a welcome relief to the deadly inaction of being cooped up in a miniature tent without room to stand. Armitage's tobacco gave out several days ago, and I am now sharing mine with him, so it will also be soon finished. I therefore wish to economise it as much as possible. We never smoke when on the march or when doing hard work, but only when camped in the tent.

The weather continued very bad all day and grew worse with a fast-falling barometer towards night.

Just as we were finishing dinner, about 7 P.M., the dogs set up a very distinct yell of "Bear!!!" I quickly got my rifle out, and on opening the tent saw her about fifty yards off coming along our tracks of the day before towards the camp. As she came up I gave her a shot in the neck which did not immediately stop her, although I afterwards found that the bullet penetrated the chest, cutting a large blood-vessel, and filling the chest-cavity with blood. I quickly followed with two more shots as she made off, both taking effect, and one breaking her hip on the left side. She then fell down, but tried to drag herself towards the glacier-face, when, as I had fur boots on and did not wish to get them full of snow, and Armitage was wearing his leather "laipshko," I sent him to put a bullet through her head.

We then went down to her and cut her up, and sledged the meat back to camp with the dogs, which

viewed the proceedings with huge delight. I cut off as much meat as I could and saved all the blubber for cooking purposes; she was, however, in poor condition. We gave the dogs a huge dinner, and they have gorged themselves as full as they can hold, poor brutes. I am very glad to have got this bear, as it comes in extremely useful. This is the first we have seen since leaving the hut. She was an adult female. I took the claws and canine teeth as mementos of the kill. It went to my heart to leave the skin behind, but of course it was quite out of the question to carry it.

April 23rd, Friday.—The weather has not improved at all, and the barometer refuses to rise. After having breakfast, as the mist lifted a little, Armitage and I started over the steep rise above Cape Ludlow to get a look into Cambridge Bay, to see, if possible, the condition of the ice there. On topping the slope Capes Neale and Crowther showed out dimly through the mist. It appears as if there was a way across the ice some distance up Cambridge Bay to Cape Neale, but the open water looks as if it wrapped round the Cape. It was, however, too misty to be at all sure. We got a good run back to camp on our ski down the steep ice-slope with a fresh south-east wind behind us. I am feeding up the dogs, and they are gorging themselves to their hearts' content. The rest and fresh bear meat will do them good.

I changed the films in the half-plate and hand-cameras and altered the lashings on my ski and did various odd jobs in the tent.

Our tent has become an absolute swamp, and everything we have about us is very wet. Pitched as it is upon the side of the glacier, the floor has a considerable incline downwards, and we are constantly sliding down

amongst our cooking utensils at the lower end, and it is difficult to prevent this involuntary toboggan-like movement. The wind increased again towards the afternoon with more snow-fall. The thermometers show about ten degrees of frost. Uncomfortable as the wet is, I now hope we shall have no very decided fall of temperature, as our furs will become unusable, and we shall be unable to get into them at all.

April 24th, Saturday.—The wind dropped somewhat during the day, but the mist still continues thick. We packed up after digging out the sledges, and carried as much of the bear-meat as we can manage to. We started with single sledges up the steep incline above Cape Ludlow rising to about eight hundred feet. The weather soon after we started again became worse. Snow fell and a fresh south-west wind met us in the face. The temperature showed 16° of frost, which, with the atmosphere saturated with moisture, soon coated us and our belongings with a thick sheet of ice. The haul up the steep ice-slope was very hard work, and we had to stop every twenty or thirty yards. On reaching the summit and bringing up the two sledges together we stopped for food, and then started off with them together, favoured by the incline downwards. This, however, did not last long as I had to direct our course N.N.E., and even sometimes north, as the ice is broken up for some distance down Cambridge Bay. The mist continued very dense, and ten yards around in any direction bounded our vision. After going as I believed sufficiently far to clear the open water and to get down upon the fast ice, we struck about north-east and began to descend rapidly. The dogs got scared at the sledges following upon them, slewed round, upset me, as I was attached to the traces, and capsized the sledges.

It had then come on to snow still heavier, and we could hardly see beyond the point of our ski, so I decided to camp until it clears, as I am afraid that in this gloomy darkness we may fall over the glacier face before we see it. The weather looks as ugly as it can and shows no sign of improving. This is a truly diabolical climate!

We camped on the north-east side of Cape Ludlow and overlooking Cambridge Bay. We travelled about three and a half miles by various courses. The wind changed to S.S.W. before we stopped.

The dogs went badly, being gorged with meat, and gave much trouble, and yet who would have the heart to refuse them as much as they can eat after all they have gone through, when there is plenty of meat and more than we can carry? Poor brutes!

There is a popular picture of dog-driving—of a man seated on a sledge twirling a long whip around his head and careering gayly along at the rate of ten or twelve miles an hour behind a team of dogs. This unfortunately is anything but a true one. We never think of riding upon a sledge, but are more than contented if it can be kept in motion at a slow walk by the united efforts of the animals and ourselves. I haul in a trace ahead of the dogs and lead the way, while my companion by continuous shouting and occasional use of the whip keeps the dogs at their work, and whenever the sledges stop—which they do at the smallest obstruction—by hauling and shouting get them started again.

Climbing the steep incline of this ice-clad land entails excessive labour, hauling our sledges simply foot by foot, as the five remaining dogs stop every few yards, and can only be started again by hauling up the sledges and by shouting ourselves hoarse. The whip is of little use when every muscle has to be strained to move at all,

and besides being repugnant to any one fond of animals, tends to discourage rather than to spur them on, and Mr. Armitage seldom uses it.

April 25th, Sunday.—Soon after we stopped the S.S.W. wind increased to a gale, with heavy snow, which continued throughout the night, and this morning it is blowing a fresh gale with very heavy snow. The barometer has sunk over half an inch during the night and now stands at 28.33 (10 A.M.).

We shall have again to camp until the weather shows some improvement. These wretched bad-weather-camps are endless! It became worse instead of better as the day went on, and the wind increased to a strong gale in the evening and at times to a full gale. The barometer had fallen to 28.09.

The tent seemed at every moment to be on the point of being carried away in spite of our weighting it down with everything available, and sitting upon the bottom. In the course of the night the wind cut all the snow off the snow-cloth and lifted one side of the tent. The snow drove into it in clouds and rapidly covered us with several inches of it. I managed to secure it partly by turning the cloth inside and piling my rifle, our food, and other articles upon it, but shortly the wind blew up a corner and a steady drive of snow into the tent went on. We could not go outside to put it right, or the tent would have blown away, so we had to put up with it.

Above the roar of the furious gale frequent howls and whines from the dogs showed that they were having an equally unpleasant time of it, and the poor wretches could not sleep. The temperature began rapidly to fall with a change of the wind to north-west.

April 26th, Monday.—Our camp presents about as uncomfortable a spectacle as it is possible to imagine.

The tent half full of snow, the sides bellied in, giving hardly room to stir an inch, and the constant flap of the canvas brings clouds of snow down upon us. Armitage's cheerful, plucky endurance under conditions of great privation and trial impresses me much. He is a capital companion to have, and I could not wish for a better.

We lay in our militzas until 1 P.M. listening to the roar around us, and to the whines and howls of the unfortunate dogs. Then hunger drove us out, and under great difficulties we got some food cooked over our smoky fat-lamp, and we again lay down, as space will not allow of any other position. We have all but run out of spirit and are obliged to use the bear's blubber to warm our food with—I won't say cooked, for it is like trying to do so over very smoky candles, and its fumes fill the tent and make us the colour of sweeps. I had tried to eke out our spirit with the small supply of whisky we had been keeping for emergencies, but it does not burn well, and we rather regret the experiment. The little that remains of our spirit I keep for use when actually on the march.

About 6 P.M. the wind lessened to a moderate gale, and we set to work to feed the dogs and to make our tent more habitable. Thus the day was passed in about as uncomfortable a manner as can be imagined.

The temperature has fallen to a degree or two below zero, and our dripping furs are now getting like suits of armour.

The barometer is rising, thank goodness.

April 27th, Tuesday.—I turned out at 2 A.M., and finding an improvement in the weather, I decided to make a start at once.

No sooner had we begun to get breakfast than the wind again woke up to a strong breeze. This, how-

ever, died down again, and a clear, sunny day opened up. I intend to march during every minute of fine weather vouchsafed to us, or we shall never get away from this wretched district of endless gales and bad weather. I intend to tramp on from the time one gale ends until another begins. I took several tele-photo negatives of Capes Fridtjof Nansen, Neale and Crowther. I made sketches and took angles of the prominent features of Cambridge Bay to fill in my map. I feel sure that it runs out to the north-east of our camp of April 7th, as I can now see up the channel I then discovered on going down to the shores of the small inlet of the bay. As the glacier appears to gently incline downwards to the bay in the direction of Cape Neale, we started off with breaks on the sledges direct for it. We have only just gone far enough north-east to round the open water. After proceeding about three miles we approached close to the edge of the glacier fronting the bay, when on my running ahead of the sledges on my ski, I found to my disgust that a high glacier face from fifty to sixty feet high without a single snowdrift against it to enable us to get down to the sea-ice skirts the bay. We were on a high shield-shaped ice-clad land, fringed with a precipice of sixty feet above the smoother sea ice which lay below us, and yet we had no means of descending to it owing to this high ice-wall.

We had now to a large extent to retrace our steps to make for an inlet in the bay further north, where the glacier comes down less abruptly. I started off ahead, skirting the glacier face to find the nearest way down, leaving Armitage to slowly follow in my tracks with the sledges.

On returning after achieving my object of finding a descent to the bay, I learnt that Armitage had been

having a bad time with the dogs, which were drawing the sledges, who finding them run easily downwards towards the glacier precipice, had swerved off at a run in that direction. Fortunately Armitage had only one sledge attached to the dogs at the time, and he just succeeded in stopping them on the brink of the perpendicular ice-walls below by throwing himself in front of the runners. Another second and they would all have been dashed to pieces upon the ice of the bay beneath. One of his own ski, however, became detached from the sledge on which they were fastened, probably owing to the sudden check, and slid over on to the floe below, a drop of sixty feet at this point.

By taking the sledges singly for a mile and a half, and then returning for the other, we got them to the top of the descent into the inlet I had found, and about noon managed to get down on to the sea ice, to our sincere relief.

We then skirted the glacier face for some distance, and camped for lunch on the edge of some very rough ice. I here left Armitage to make a pot of tea and to put the tent up roughly, while I started off to find his ski. This I did about a mile further on. A bear had that morning, as I could see by his tracks, followed the glacier face round, going towards Cape Ludlow.

We got the sledges through the rough ice after some hard work, and then came upon a fine level stretch over which with frequent spells to rest the dogs we went comparatively easily. I hauled as usual in front of the dogs, and by straining every muscle kept the sledges moving.

The barometer had again begun to fall, and dark clouds were coming up from the south-east, indicating clearly more bad weather in prospect. I determined to make the most of what fine weather still remained.

At 6 P.M. we stopped and had a little food, of tea, biscuit, and fat bacon, and then on we went again. The dogs had got very tired, and if unintentionally I relaxed my efforts in hauling for a moment they at once stopped, and any snow-drift to ascend at once produced the same effect, requiring all our efforts in pulling up the sledges, and hauling on them to start again.

The ice now became extremely rough, with deep snow between the smashed up pinnacly hummocks, giving us incessant labour to get on at all.

About midnight, when checked at some rough ice, and happening to turn round, I saw a she-bear followed by two cubs about fifty yards off, coming towards us from behind at a fast run. I hurriedly got out of my trace and ski, and pulled out my rifle, just in time to put a bullet through her head as she came up. It was fortunate that I saw her when I did, or she would have made it lively for us. She dropped stone dead close to the rear sledge, and the cubs took to their heels on meeting with such an unexpected termination to their little hunt. Mamma bear was evidently going to instruct them in the art of catching seals, or whatever she imagined the strange objects on the ice to be.

I then started off on ski to capture the two cubs, as I did not wish to leave them to die of starvation, and they were not old enough to delve for themselves. The young beggars ran like hares, and not feeling inclined for a race after the day we had had, I returned and got my rifle, and by stalking the young villains I put a bullet through each, sorry as I felt to do so. If I could have caught them I would have tried to utilize them as draught animals, and so have enabled them to prove their use in life ; but I expect there would have been awful rows about it.

If the mother would have left us alone I should not have meddled with her, but as she was determined to make a supper of us I had no option. Having killed the mother I felt it was cruelty to leave the cubs to starve (they were only about two months old). I took the claws and canine teeth of the old bear, and the four paws of the cubs as mementoes, and gave the dogs a feed on the meat. We then started on again. The tumbled up ice and deep snow now became worse than ever and about 2.30 A.M. I found that, with our utterly exhausted dogs, and ourselves a bit tired, it was out of the question to force our way through it without a rest all round. It had come on to blow strongly from the south-east with driving snow, and the weather looked very threatening. We have quite used up all the brief spell of fine weather, and another gale is imminent.

At our camping place about seven miles off Cape Neale, I ascended a hummock to look for the best way through the rough ice, when to the south (true) I saw a dark object on the ice a mile or so away. I got the telescope, and found it looked uncommonly like a dirty tent with something waving in front of it like a small flag on a staff. I called Armitage, and he came to the same conclusion. The light, however, was so bad, and the snow driving before the wind at times completely hid it, so we could not say what the object was. I took a bearing of it, and as soon as the gale ceases I intend to go and investigate the matter. Can it be the *Fram* party?

We had some food, and then turned in. With the fall of temperature everything is as hard as rock, and we had awful work to get into our furs, which took us over two hours to accomplish.

We have had twenty-eight hours of it without a break, twenty-five being spent in sledge hauling. We are pretty

tired. We have the satisfaction, however, of knowing that we have covered a good distance through sheer hard work. We have marched twenty-seven miles altogether, which I think is a very good record considering the conditions.

The very heavy gale we experienced on the 25th and 26th, when upon the high glacier about 1200 ft. up, does not seem to have blown nearly as hard on the ice in Cambridge Bay, where the snow lies soft and almost undisturbed, whereas upon the glacier it was packed hard by the wind, and cut into deep ridges and trenches by its force. The wind evidently rushes from the comparatively warm open water to the south of us towards the high, cold, glaciated country.

April 28th, Wednesday.—It has been blowing a moderate gale from south-east all the time we have been asleep with thick driving snow, and when we turned out at 4 P.M. it still continued. The sky is overcast and heavy with thick mist, and the weather looks as unpleasant as it well can do. It won't give us half a chance.

I wrote the following record to place in our camp cairn upon Cape Neale to-morrow with three cards, if we can only get on :

“THE JACKSON-HARMSWORTH POLAR EXPEDITION.

“Two members of the above Expedition reached this spot on April 29th, 1897, having rounded Western Franz Josef Land by way of the British Channel, the North Coast, and Cape Mary Harmsworth. We have been much bothered with bad weather and open water, and have been frequently forced to travel on the glaciers to avoid it.

“We have lost all our animals except five dogs.

OUR LUNCH CAMP UPON CAPE NEALE

We are now returning to Cape Flora by way of Cape Grant and Bell Island.

(Signed) "A. B. ARMITAGE.

"FREDERICK G. JACKSON,
"Commanding the Expedition."

I melted down for cooking purposes more of the blubber I got from the bear killed on the glacier. The one I shot yesterday had not an ounce of fat upon her.

The wind dropped late in the evening, but the sky remained overcast with a good deal of mist, and snow fell.

The supposed tent turns out to be a dirty piece of fresh water ice, shaped exactly like one.

April 29th, Thursday.—We turned out at 4.10 A.M., after four hours sleep, as I could see that the weather had improved and I was anxious to get off again.

After taking several negatives of the camp and Cape Neale and a telephoto one of Cape Fridtjof Nansen, we started off with single sledges through extremely rough ice towards Cape Neale. In places we had to make a road through it with our small crowbar. Frequent capsize with the sledges occurred, and I was heartily relieved on reaching the cape to find, on getting on to a small level floe which had been protected from the south-east pressure by grounded bergs, that neither sledge was broken. Certainly rougher or more difficult ice there is none in the polar basin than that through which we have come, being crushed up against the land and tumbled over and over in the wildest confusion.

We travelled round the front of the cape on the level floe, which, however, was sticky from salt efflorescence, and the sledges dragged heavily. We put up the tent for an hour for lunch at 4.30 P.M. by the cairn at our old

camp of July 1895. At Cape Neale we heard again the hum of birds from roches upon the cliffs. The sound has great charm for our ears after our sojourn in the silent life-



SKIRTING THE GLACIER FACE

less, deathlike country of ice and snow to the north-west, where the cry of a bird was never heard, but all was as still as the grave. Bears had pulled out the piece of driftwood which we had stuck in the top of the cairn ; had hauled

down the flag on the cairn on the rise of the talus, and had pulled down the driftwood we had put firmly on end near the shore. They are mischievous wretches. I took several negatives here, and we then pushed across the ice towards Cape Crowther. At the termination of the level floe half a mile from Cape Neale we came upon, if possible, worse ice than we had met with on the other side of the cape. We pushed into it, but found it was so bad that we returned, and I determined to follow the glacier face round upon the snow-drift, on which, although anything but good, we got on better. At the foot of it I noticed numerous tracks of bears—a regular bear promenade in fact, and that I always view as an indication of the best way, for bears are very good judges.

We pushed on until 9.30 P.M. when we camped opposite some low basaltic rocks that jut out of the glacier about half way between Capes Neale and Crowther.

The weather after 10 A.M. has been beautifully fine, and with the exception of local winds from the cliffs and glacier there has not been much.

The temperature fell from $+32^{\circ}$ when we left camp in the morning and showed 27° of frost when we stopped at night. It fell to zero later on in the evening.

We had a hard and long day—viz., from 4.30 A.M. to 1.30 A.M. of the following day, when we turned in to sleep. We only stopped once for an hour at 4.30 P.M. to have some biscuit, tea and bacon.

We did about thirteen miles direct, but went much further, and the greater part of the distance we went three times over the same ground.

April 30th, Friday.—Another fine sunny day. What a marvel! I took a series of negatives of the coast between Capes Neale and Crowther. We then packed up and started towards Cape Crowther along the glacier

face. The going was extremely bad, and frequent capsizes of sledges and going treble journeys was the order of the day.



OUR CAMP ON CAPE CROWTHER

We reached the western portion of Cape Crowther at 9 P.M. when we stopped and had some food.

The ice is in a tremendously crushed-up condition. Smashed up into pieces and tumbled about in the wildest

confusion with nothing approaching floes or even level spaces of ten yards across amongst it. Rougher ice there cannot be anywhere, and only against land or a land floe could it be so crumpled up, for there the maximum of pressure occurs and not in the open sea with little to check the movement of the ice before the wind.

IN DIFFICULTIES

All round Cape Crowther the ice was piled up against the shore giving us great trouble and hard work to get forward. The dogs stopped at every incline and could only be moved on again after a vast amount of hauling and shouting.

I examined the record cairn on the top of the low rocks at Cape Crowther, and found it quite intact, but that a bear had wrenched off the flag, leaving part of the staff amongst the stones. I stopped during the day and took several negatives of objects of interest.

We pushed on round the small tongue of glacier that

runs down between the rocks at Cape Crowther, and at 1.30 A.M. camped on the edge of the shore beneath the cliffs on the Gray Bay side of it.

The open water runs in close up to Cape Crowther and goes some distance up into Gray Bay.

On the north-west rocks of Cape Crowther there is a large loomery, also rotches, kittiwakes and dovebies were flying about the rocks. It is very pleasant to hear birds again after the silence of the dismal northern and north-western coast we have travelled over so long, where there was no sign of life except a very occasional rotche seen at a distance. Now the looms are cawing and we seem to have entered a region of life again.

The barometer has been falling all day, and the sky had become overcast by 9 P.M. with an easterly wind when we turned in at 4 A.M., it having backed from west at 8 P.M., through south-west, south-east, to east. We travelled about eight miles.

We often think what travelling over this kind of ice must have been for Albert Markham and his brave party to the north of Grinnell Land, and Beaumont on the Greenland coast with heavy sledges and most of their men ill with scurvy. What pluck and hardihood they showed of the true British mettle! as day after day they slowly and laboriously struggled on in the face of great odds and almost insuperable difficulties. The non-Arctic public little realise what those marches really meant, the splendid courage that enabled them to accomplish them, and the fine generalship of the leaders which brought their men back with such comparatively small loss.

May 1st, Saturday.—The wind has been blowing in heavy gusts from east since 4 A.M. yesterday, and when we turned out about noon they had increased a good deal in force and frequency, being almost continuous, with

falling and driving snow and dense mist. The barometer has been falling rapidly and there is every appearance of our being condemned to another "bad-weather-camp." We have had, however, two fine days, so we mustn't growl, I suppose.

The weather quickly became worse and compelled us to remain camped. The interior of our tent is emphatically the reverse of comfortable. Everything we have about us is in a state of noisome moistness; our clothes are very damp, our furs are wet and rotting, and cause a fearful stench. The smoke from the fat-lamp which I made out of an old tin has blackened everything, and when in use fills the tent with volumes of black greasy smoke. It is very annoying to be thus delayed, for besides of the discomfort of such camps, I am anxious to get back to the hut on Cape Flora to refit and start for Hooker Island to map in the country in the neighbourhood of Brady Island. The ice will soon get very bad for travelling and time is getting on.

May 2nd, Sunday.—It has been blowing a fresh gale all night with almost continuous heavy gusts of force 10, with thickly falling and driving snow, and as thick a mist as I have ever seen. The barometer has fallen nearly half an inch during the night, and this morning the weather is vile.

The fat-lamp is making a horrible mess of everything in the tent, volumes of black greasy smoke being given off whenever it is lighted. This mixes with the condensation of snow and frost on the sides and top of the tent, and showers black rain down upon us on the sides being touched, until we begin to look like negroes, which the wash I take every morning only partially relieves. We have been sitting in the tent endeavouring to keep ourselves warm, and doing any odd jobs, such as repairing

the dog harness, that comes to hand. Armitage and I have almost talked ourselves conversationless. Our discourse naturally has, as a rule, reference to Arctic matters, the splendid sledge journeys made by M'Clintock and his able assistant Allen Young, the retreat of Leigh Smith and Dr. Neale in their boats to Novaya Zemlia, or Payer's adventurous and plucky journey up Austria Sound, all and everything is discussed threadbare. Then we lapse into silence, until some brilliantly new idea occurs to one of us, and the conversation is renewed.

The weather eased down somewhat towards night, and the wind changed to north-west and blew in hard gusts, caused by the high cliffs above us.

May 3rd, Monday.—It has been blowing in hard gusts throughout the night, which increased in force this morning, so that to prevent the tent being lifted up we had to weight it down with heavy stones off the cape. Owing to the wind chopping round a lot of fine snow has been driven in through the entrance covering everything inside, which is soon converted into water owing to the rise of temperature. Things are not exactly the acme of comfort to say the least of it. The barometer is slowly rising and the temperature falling (the thermometer has been racing up and down lately from freezing point to 10° below zero). We hope the weather will soon enable us to move on again.

Towards noon the weather improved and we packed up and started at 12.40 P.M., pushing on round the cape close to David Island and across Gray Bay towards Cape Grant, edging away some distance down the bay to avoid rough ice and open water. Things went very well as the travelling was good until 6.30 P.M., when we neared the glacier running up to Cape Grant; there, much to our disgust, we saw that the open water extended right up to

the glacier face, quite cutting us off from rounding the Cape.

Armitage got some food ready while I set out on ski to try and find a snow drift against the glacier face up which we could haul sledges, and enable us to cross the

“MUCH TO OUR DISGUST WE SAW THAT THE OPEN WATER EXTENDED
RIGHT UP TO THE GLACIER FACE, QUITE CUTTING US OFF FROM
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high glaciated land behind Cape Grant into Nightingale Sound.

I found that canoeing our gear round—about a mile so far as we can see—was out of the question, owing to the probability of the narrow water space closing up with the tide or wind before we had half finished, and after the banging about my canoe has had, I doubt very much if she is water-tight, but I expect leaks like a sieve; the water too may wrap round the cape, and Nightingale Sound may be open water also. I found that there was

no place where it was possible to get up the glacier face nearer than close to the head of Gray Bay, so after having our lunch we started off to climb the glacier, much as it is to be avoided, but there is no help for it. After going about seven miles I found a difficult and steep place formed by a drift against the face of the glacier where it is about fifty feet high. It was, however possible, so we set to work at it. We had to proceed very carefully owing to ugly crevasses between the glacier itself and the drift, which led down to the tide crack and the sea sixty feet below, from which a man would never get out of if he fell into, and on the other side was the precipitous face of the drift, with a narrow ridge between, along which we had to drag the sledges. However, after an excessive amount of hauling and tugging, which took us hours, inch by inch we at last got them up without accident, and having harnessed the dogs again, we started up the steep glacier slope with a single sledge at a time. This the dogs and ourselves drew with the utmost difficulty, the steepness of the incline causing the dogs to stop every eight or ten yards in spite of our strenuous exertions.

After taking the first sledge up five hundred feet I noticed a bear on the floe below making for the sledge with our provisions upon it, which was standing at the top of the glacier face. As we could not afford to entertain a visitor of his capacious appetite, I rushed back down the glacier upon my ski with my rifle to stop his plundering intentions from being carried out, and as we have now no want of meat, and I did not wish to kill him unnecessarily, I yelled and did my best to scare him. He at last moved off without robbing the sledge, and walked leisurely towards the open water to the south.

CLIMBING THE GLACIER FACE

We then proceeded about another hundred and fifty feet higher, and bringing up the two sledges together, camped at 2.45 A.M., having marched for fourteen hours, and had a pretty tough day of it.

We travelled in all twenty-one miles direct.

May 4th, Tuesday.—The day opened misty but fine,

ON THE PEARY GLACIER

and the temperature shows 18° of frost. I took a few negatives of Cape Crowther and the coast, and we then started up the steep incline with single sledges, which took us all we knew to move at all. The dogs stopped every five yards, and only after great hauling and tugging could we get the sledge on again. I hauled in front, as usual, but took my ski off at the steepest parts to get more power to bear upon the snow.

We at last got the two sledges to the top of the

dividing ridge. The top is flat for only about two hundred yards, and then the downward slope begins, two and a half miles from Gray Bay, and we could then see over into the bay to the west of Cape Stephen, which I named Josephine Peary Bay, after Mrs. Peary, the wife of the Arctic explorer, as well as into Gray Bay. We then proceeded down a more gradual slope into the bay, and only at one part of the descent were brakes on the sledges necessary, but the glacier is more crevassed than on the Gray Bay side. I went on ahead here to find a way down, the dogs following in my ski tracks. We got down on to the sea ice again at 8.30 P.M. at the head of Josephine Peary Bay and then pushed on to the point of Cape Stephen. The open water comes close in here round Cape Grant and runs right up to the Cooke Rocks.

Near our old camp of August 1895 we stopped for a few minutes and had some food. While Armitage packed up I went up the talus to examine the ice towards Bell Island. The open water extends in a crescent-like form some distance up Nightingale Sound, obliging us to make a considerable detour towards the north. We trudged on but found the floes very deep in snow and boggy in places. Mist came up which quite hid Bell Island, and heavy snow storms with a south-east wind hindered us somewhat. We pushed on, I in the traces hauling and leading the way, and Armitage bustling up the dogs, which went very slowly and laboriously. About three miles off Cape Stephen we saw a bear coming at a rapid rate towards us from the northward. I got out my rifle, but as he approached he adopted more cautious tactics, and began leisurely to stalk us. As we had no time to spend over him I fired a shot or two at a long range, and cleared him out, and we then went on again. The floe

was exceedingly heavy with deep snow. The sledges hauled badly, and in places there was water beneath the snow.

Mist had obscured all land, and I had to lay my course towards Bell Island by the direction of the wind and the trend of the open water about a quarter of a mile to the

A REST ON THE MARCH

southward of us. Snow began to fall heavily, but we struggled along as best we could, both the dogs and ourselves being very tired, the former nearly dead beat, until 4 A.M., when we stopped for an hour and made some cocoa with luke-warm water over the fat-lamp, and then on we trudged again.

Armitage and I began to feel a little tired too, for we have been at this work for sixteen hours, and several times when the dogs checked at hummocks we laid down in the snow and all but fell asleep. However, it

was of no use lying there, so on we pushed again, but the labour of hauling the sledges out of drifts, starting the team again, and urging on the animals insured our sleeping soundly when the time came that we might, feeling quite indifferent as to whether our couch was downy or otherwise.

About 9 A.M. of the following day the mist partially lifted and the snow stopped falling, showing us Bell and Mabel Islands about four miles distant. As we approached nearer we could make out a dot on the spit of Bell Island, which very slowly became larger and eventually proved to be Leigh Smith's hut. We at last reached it at 11.30 A.M. (of the 5th of May), and after digging away the snow-drift with my canoe-paddle we got inside and proceeded to make ourselves comfortable, and to satisfy our thirst, which required three quarts of cocoa and coffee, which we had left there in 1895, to do it. We suffered greatly from thirst on this journey, and our tongues and mouths were constantly as dry as a rasp. I have lived in tropical countries and know what heat is, but nowhere have I suffered so much from thirst as when sledging in the Arctic. To replace our dirty, smoky fat-lamp with spirit, two tins of which we had left there in August 1895, is also a great boon.

What a relief it was when we stood before Leigh Smith's hut: here at all events we could stretch our limbs and stand upright under cover, for bare as it was, it was a palace to what we had been accustomed to. We groped about for possible treasures, and we were rewarded—well rewarded—for we discovered a few ends of cigars and cheroots thrown away by Mr. Smith's party fourteen years before, which we eagerly cut up and smoked, and never probably was any tobacco more appreciated than those few odds and ends that day, for we had been out of

tobacco for some time past. We had turned out at 10 A.M. on the 4th and started at 11.45 A.M., and continued our march until 11.30 A.M. of the 5th, it being in all close

BREAKFAST IN THE HUT ON BELL ISLAND

upon twenty-four hours' continuous, hard sledging. After having a little food we felt as fit as possible again. We travelled in all twenty miles direct. We are both of us much thinner than when we left Cape Flora, but are in

first-rate training and as hard as nails. Three years in the Arctic evidently has not hurt us much.

We had been here about four hours, had some food, straightened things up generally, and were on the point of going to sleep, when, hearing the dogs barking, I got out

AN ARCTIC HIGHWAY

my rifle thinking a bear was approaching. Armitage who had looked out of the door returned to say that three figures were approaching, which soon proved to be Dr. Koettlitz, Wilton, and Bruce dragging a sledge. They had become anxious about our being overdue, and had formed a possible relief party to look for us, carrying provisions for us. As we were out of tea, sugar, tobacco, &c., which they were able to supply, we soon revelled in the midst of luxuries. Strict economy was at an end, and big feeds the order of the day. We formed the jolliest party in the world; our news was

eagerly inquired for, and many were the congratulations expressed at the success of our journey.

All had gone well during our absence, and every one

THE FIVE SURVIVORS OF THE SPRING SLIDGING (1897)



was fit and well. The party had left Cape Flora two days before, and had camped off the coast of Mabel Island the first night.

May 5th, Wednesday.—After discussing our news we

turned into our furs at 9.30 P.M. The weather had become bad, with an easterly wind and falling snow. Only one bear had been seen at Cape Flora during our absence, and he had escaped.

The doctor and his party insist upon cooking and doing everything for us, and are most kind in every way. We feel in clover indeed.

May 6th, Thursday.—Blowing hard from the east, with falling and driving snow and thick mist. The thermometer has fallen to 7° below zero during the night. I intend to remain under cover here until the weather improves, and Armitage and I are congratulating ourselves on not being out in another bad-weather-camp on the floes between here and Cape Stephen. We quite feel that our exertions of yesterday are rewarded. It can blow and freeze as hard as it likes now.

May 7th, Friday.—The day opened bright, clear, and colder, with a north-east breeze. I took a number of negatives, bearings and sketches of points in Nightingale Sound. I left a note upon the wall for the *Fram* party, if by any chance they should reach here—the most likely spot if they make for Franz Josef Land:

“ *To the Leader of the ‘Fram’ Party.*

“ The Jackson-Harmsworth Polar Expedition are now living on Cape Flora, where there is a hut and plenty of provisions. Communicate at once with us should you arrive here.

“ FREDERICK G. JACKSON,

“ Commanding the Expedition.

“ May 7th, 1897.

“ I have left provisions in this hut for you.—
F. G. J.”

We then packed up and started for Cape Flora. An easterly wind had got up just before we left, which as we neared the land rapidly increased to a gale, with driving and falling snow.

The dogs went well, although the floes are very deep with snow, but they seemed to understand that the journey, and their privations and hardships, were nearly over for the present, and certainly they recognised Cape Flora. The rest and big feeds of the last two days have done them a lot of good.

We stopped for lunch about three and a half miles from Cape Flora and reached there at 10 A.M. of the 8th of May (Saturday). Heyward saw us coming and met us on the floe, and I learned from him that everything had gone well.

The weather had become worse as the day advanced, in spite of a rapid rise of the barometer in the evening. Every one is very pleased at the success of our journey.

Heyward had seen two bears since the doctor and party had left to look for us. I left a large quantity of provisions at Eira House for the use of the *Fram* party in the event of their reaching there. I consider it to be the most likely spot in the country for them to make for, as they know of this hut.

POSITIONS BY OBSERVATION OF ☉

MADE ON SPRING SLEDGE JOURNEY, MARCH 15TH TO MAY 8TH, 1897.

March 22nd	Latitude per Meridian Altitude	=	80° 31' 49" N.
„ 23rd	„ „ „ „	=	80° 37' 20" N.
„ 25th	„ „ „ „	=	80° 40' 00" N.
April 4th	„ „ „ „	=	80° 48' 32" N.
„	Longitude per Chronometer	=	49° 17' 17" E.
	Worked with Latitude		80° 48' 00" N.
April 5th	Longitude per Chronometer	=	48° 25' 21" E.

284 A THOUSAND DAYS IN THE ARCTIC

April	5th	Worked with Latitude	=	80° 47' 00" N.
		Declination	=	13° 53' 33" E.
"	7th	Latitude and Longitude per Sumner's method of double Altitude	=	80° 52' 03" N. = 46° 53' 55" E.
		Declination	=	13° 38' 36" E.
"	13th	Latitude per Meridian Altitude	=	80° 35' 40" N.
"	20th	" " "	=	80° 29' 38" N.
A. B. A.				

ABSTRACT OF WEATHER ON SLEDGE JOURNEY, MARCH 15TH TO MAY 8TH, 1897.

MIERS CHANNEL.—*March 15th.*—Left Elmwood at noon of March 15th, in calm, fine clear weather, almost cloudless sky, and temperature at 21° F., which decreased to −30° at 4 P.M., and −40° at 8 P.M.

March 16th.—We camped off Windward Island, and on turning out found the weather completely changed, a moderate northerly gale blowing, the temperature −10° F. and still rising, till at 8 P.M. it was −4° F., the wind at that time rapidly decreasing. There was a very thick mist, with overcast sky and falling snow during nearly the whole day. Max. thermometer −10° F., Min. −40° F.

March 17th.—On turning out found that the sky was still overcast with mist, but only light northerly winds blowing (unsteady between N.N.W. and N.E.). Continued overcast, thick weather throughout the day, some snow falling towards evening.

March 18th.—Light airs and winds from N. through E. to S.E. to-day; generally overcast, thick weather, but occasionally clearing overhead for very short periods of time.

BRITISH CHANNEL.—*March 19th.*—Light to moderate wind, veering from east, through N. to N.E. during the day. Overcast thick weather throughout; very occasionally clearing as yesterday. Temp. between 0° and −5°. Max. +0.5°; Min. −5°.

March 20th.—Light airs and winds from N.E. throughout. Generally overcast, clearing and clouding at intervals, showing fine clear weather overhead, and thick mist with fine falling snow below. Temp. −9°. Max. −4°; Min. −7°.

March 21st.—Calms and light airs and winds from N.W. throughout. Fine and clear until 4 P.M., when it clouded over once more, and again became thick. The temperature fell to −23° during the day.

March 22nd.—Light airs and wind, blowing unsteadily from all round the compass during the day. Overcast and very thick weather throughout, with falling snow.

March 23rd.—Calms and light airs throughout Overcast and very

thick in early part of forenoon, but quickly cleared and became very fine for the remainder of the day, the temperature falling to -33° F.

March 24th.—During the night we could hear hard gusts of wind blowing round the tent, and the snow driving thickly, and found on turning out a fresh gale blowing from N.W., so did not break camp. The gale continued during the day, moderating towards night, the thickly driving snow having buried our sledges. The sky was fairly clear. Temp.: Max. -8° ; Min. -36° .

March 25th.—On turning out the weather was overcast and gloomy, but there was no wind; the sky cleared, and there being generally a promise of a short spell of fine weather. At noon a light S.W. wind sprang up, which quickly increased to a strong gale, with very thick mist and falling snow. However, on rounding a point of the glacier we were comparatively sheltered, the wind only reaching us in furious gusts, driving the snow round us in a perfect whirl, so that we could not see more than three yards in any direction, and had perforce to camp. Temp. throughout -12° F.

March 26th.—Had heard heavy masses of snow falling from glacier during the night, which caused the sea to flood the floe where we were camped, so had to shift (after digging out our completely-buried sledges) in a strong S.W. gale farther on to the floe, and again camped under the lee of some crushed up ice. Temp. about -12° throughout.

March 27th.—Light S.E. winds; very fine and clear throughout. Temp. rose to $+10^{\circ}$, but fell again to -16° by 8 P.M.

LEIGH SMITH SOUND.—*March 28th.*—Similar weather. Light airs (S.E.) and calms. Towards night became cloudy. Clouds driving rapidly overhead from S.W. Temp. about -21° F. throughout. Max. -6° ; Min. -26° .

March 29th.—Moderate S.W. gale blowing throughout day, overcast sky, thick mist and falling snow. Max. -5° F.; Min. -23° F. Weather moderating at 6 P.M.

OFF NORTHERN COAST ON QUEEN VICTORIA SEA.—*March 30th.*—Fine clear weather throughout. Calm and light easterly winds in forenoon. Moderate to strong wind in afternoon. Temp. -18° ; Min. -36° . Clear overhead generally, but not being able to see land around us because of driving snow, did not break camp.

April 1st.—Wind veered from the W. through N.W. to N., blowing variously and light to fresh breeze, and finally becoming calm at 8 P.M. Fairly clear overhead, but mist hanging about low down. Temp. ranging between -20° F. and -30° F. during the day. Max. -22° F.; Min. -45° F.

April 2nd.—Light N.W. and W. winds, and fine clear weather throughout, with much refraction. Max. -27° F.; Min. -42° F.

April 3rd.—On turning out there was a light W.S.W. wind blowing. Sky very cloudy, threatening, rather thick low down. Broke up camp, however, and proceeded. Temp. had risen to -7° F., Min. being -46° F. (our lowest on this journey). The wind quickly rose to moderate, fresh, and strong gale, the sky being overcast, with thick mist and falling and

driving snow; this continuing till 1 P.M. of 4th inst., when it moderated, and quickly decreased to light W.N.W. wind.

April 4th.—Light to moderate westerly wind, fine clear weather till 7 P.M., when it became again thick. Max. -30° F.; Min. -10° F.

ON NORTH-WESTERN LAND.—*April 5th.*—Calm and fine clear weather until 6 P.M., when the sky quickly clouded over, and a fresh gale from the S.E. quickly sprang up, with very wet falling and driving snow, becoming so thick that we could not see how to shape a course, although on land. The temperature rose to $+9^{\circ}$. This continued till 2 A.M. of the 6th inst., when the gale moderated.

April 6th.—Gentle to light N.W. and W. winds, and fine clear weather. Temp. again fell to -30° F.

April 7th.—Calm and light N.W. wind, fine and clear weather till 5 P.M., when the sky quickly clouded over from S.E., and by 10 P.M. a fresh S.E. breeze was blowing with thick falling driving snow. Min. -40° F.

April 8th.—During last night the wind was blowing in fierce gusts from the S.E. with occasional lulls, and on turning out, it was blowing a moderate to fresh gale, with driving snow. Overcast and very thick. The temperature rose to $+26^{\circ}$ F., making everything very wet.

April 9th.—A moderate S.E. gale blowing generally throughout the day. Overcast and very misty weather.

ON WORCESTER GLACIER.—*April 10th.*—Light S.E. wind, thick mist and overcast. As we ascended the glacier a continuous S.E. wind was blowing unsteadily, which increased to a gale at midnight.

April 11th.—Strong S.E. gale throughout, overcast, very thick, and very thick falling and driving snow, which buried our sledges entirely.

April 12th.—Moderate westerly wind throughout, overcast and very thick, with falling and driving snow.

April 13th.—Calm in forenoon, clear overhead, mist low down, light to moderate S.E. wind.

April 14th and 15th.—Cloudy with mist until 10 P.M., when it became overcast with thick mist, the wind increasing to a gale at 11 P.M., which continued till 9 P.M. of the 15th inst., when it moderated, veering through S. to W., and gradually decreased to calm at 6 P.M. Overcast and exceedingly thick, wet falling and driving snow during the whole of the 14th, gradually clearing on the 15th inst., until at 6 P.M. it was very fine clear weather.

ABOVE CAPE MARY HARMSWORTH.—*April 16th and 17th.*—Fine and clear with much refraction in early morning, clouds passing rapidly over from south. Sky quickly became overcast with thick mist at 2 P.M., the wind increasing to moderate southerly gale at 6 P.M., and moderating to light breeze at 8 P.M., breezing up again to fresh gale at 11 P.M., and throughout the night until 7 P.M. of the 17th inst., when it moderated to light breeze at 8 A.M., and calm with thick mist at 10 A.M. Fine but very misty, with light to moderate southerly and south-easterly winds the remainder of the day.

DESCENDING PAYER GLACIER.—*April 18th.*—Light airs and winds from E. and N.E., with dense mist and thick frost rime over everything, so thick to-day that we were unable to move as we were descending the glacier, and did not know how far we were from the glacier face. Weather cleared overhead in the afternoon, but still thick below on glacier. Saw a large double fog bow at noon.

April 19th.—Gentle to moderate S.E. wind throughout; overcast, with dense mist and thick frost rime. Found it very difficult to keep our course on account of the very thick weather.

April 20th.—Gentle to moderate southerly and south-easterly winds, clear in forenoon, becoming cloudy, overcast, and misty in afternoon.

IN WEYPRECHT BAY.—*April 21st.*—Gentle to fresh S.E. wind with dense mist, and falling and driving snow and sleet.

April 22nd.—Fresh wind to fresh gale from S.E. Barometer falling rapidly. Overcast and very thick. Falling and driving snow throughout.

April 23rd.—Moderate to strong wind, and occasionally gale throughout. Overcast and thick with driving snow throughout. Snow falling in latter part of afternoon, and during night.

April 24th.—Fresh to moderate south and south-westerly wind, with overcast, very thick weather, and falling and driving snow.

ASCENDING AND DESCENDING PAYER GLACIER.—*April 25th.*—Moderate to strong gale throughout from S.W., veering through W. to N.W. Overcast, thick weather, with thick falling and driving snow.

ON PAYER GLACIER ABOVE CAPE LUDLOW.—*April 26th.*—Strong to whole and moderate gale from N.W., moderating at 8 P.M. in furious gusts, which cut the snow off the tent snow-cloth, blowing up one side of tent and filling it with snow, also giving us some little trouble to keep the tent from being blown away. Overcast and cloudy weather generally, with fog and hard driving snow. Temp. fell to -10° F.

IN CAMBRIDGE BAY.—*April 27th.*—Calms and light north-westerly airs, with fine, clear weather overhead, fog low down till 6 P.M., when it became cloudy and overcast, with every promise of S.E. gale. Temp. 0° F. to -12° .

April 28th.—Moderate S.E. gale, and overcast, thick weather throughout day, moderating in the evening, and becoming calm by midnight. Temp. -12° to -22° F.

OFF CAPE NEALE.—*April 29th.*—Calm till 5 P.M., then moderate N.W. wind; very fine and clear throughout.

CAPE NEALE TO CAPE CROWTHER.—*April 30th.*—Fine, clear weather generally throughout the day, clouding over towards midnight, and the wind blowing over in sharp gusts from the northward and eastward. Barometer falling.

OFF CAPE CROWTHER.—*May 1st.*—Moderate gale from east throughout, overcast thick weather, with falling and furiously driving snow. Fierce gusts of wind every other moment caused us to place all available weights (boulders, etc.) on tent snow-cloth.

ON CAPE CROWTHER.—*May 2nd.*—Fresh east gale, with fierce squalls of wind every other moment, overcast, dense mist, falling and furiously driving, whirling snow till 4 P.M., when it moderated, though still very squally and ugly looking. Barometer very low.

ACROSS GRAY BAY AND ON THE PEARY GLACIER ABOVE CAPE GRANT.—*May 3rd.*—Moderate to gentle breeze, veering from N.W. through N. to N.E. Fine clear weather in forenoon and until 10 P.M., when it became cloudy and misty.

CROSSED GLACIER, JOSEPHINE PEARY BAY BETWEEN THE COOKE ROCKS, CAPE STEPHEN, AND NIGHTINGALE SOUND, REACHING EIRA HOUSE, BELL ISLAND.—*May 4th.*—Light N.E. wind, veering through E. to S.E., and increasing to moderate breeze, cloudy, with some mist throughout. Temp. -7° to -15° F.

EIRA HOUSE, BELL ISLAND.—*May 5th.*—Moderate S.E. wind, backed to E. at noon. Cloudy, overcast, and thick throughout, with falling and sometimes driving snow the greater part of the day.

May 6th.—Fresh to strong E. wind, and overcast thick weather, with falling and hard driving snow, until 8 P.M., when it moderated and cleared. Calm with fine, clear weather at midnight.

EIRA HOUSE TO CAPE FLORA.—*May 7th.*—Light easterly airs, increasing to moderate breeze at 4 P.M., and moderate to fresh gale at 11 P.M. from from E.S.E. Fine clear weather until 4 P.M., when the sky commenced clouding over, and as we approached Northbrook Island, it became entirely overcast, with fiercely driving snow.

Days out, 54: Fine and clear, $13\frac{1}{2}$; $40\frac{1}{2}$ bad days. Fine clear days, $13\frac{1}{2}$; fine but thick, $4\frac{1}{2}$; thick days, $29\frac{1}{2}$. Falling snow, $20\frac{1}{2}$; gales, $18\frac{1}{2}$.

CHAPTER XXX

WE LOSE OUR PROVISIONS

May 8th, 1897, Saturday.—We arrived back at the hut at 1 A.M. to-day having left Eira House, Bell Island, at 4 P.M. on the 7th.

We had some food, straightened things up a bit, and turned in at 8 A.M. At 2 P.M. we had breakfast. It was still blowing a gale from E.S.E. with thickly falling and driving snow.

I set to work to develop negatives and to clean my cabin out which had got fearfully dusty.

In the evening we had a feast to celebrate our return and the success of our journey. The doctor made a cake, which if not quite a success, was much appreciated. Heyward attempted his best "plum-duff," and a little of our port wine was produced. Every one was very kind in offering congratulations, and altogether a pleasant evening was spent.

May 9th, Sunday.—I developed negatives taken on the sledge journey and find they are coming out well. Armitage started to work out observations for position taken then. On weighing my militza I find that its weight has increased from 10 lbs. (its normal dry condition) to 27 lbs. from wet. Our soviaks and fur breeches are in a similar state of moisture and weight.

Winds S.W. 2, W.S.W. 2, S.W. 3, W.S.W. 3 to 4. Overcast and misty all day until 8 P.M., when the sky cleared $\frac{1}{10}$ th.

The temperature stood at $+32^{\circ}$ to $+34^{\circ}$ all day, and the house started to drip.

The snow outside begins to thaw rapidly and water stands in small pools under stones upon which the sun shines.

A GROOVED BERG OFF CAPE FLORA

At the hut they have experienced totally different weather to what we did to the north-west. It has been much milder here as a rule, and very little wind. They had none of the low temperatures we experienced.

May 11th, Tuesday.—The others went for a run on ski after breakfast. I attended to my negatives, swept out the hut, and then went on ski to the top of the east glacier. I then went on developing negatives up till 4 A.M., which are turning out very well. Some have curious markings upon them which at present I am quite unable to account for. I took eighty half plate negatives

and one hundred quarter plates on the late sledge journey.

May 17th, Monday.—On turning out this morning I heard sounds of barking on the floe. I sent Armitage, who had his boots on, to look over the bank and ascertain the cause as I expected that it was a bear. He returned

“AFTER BREAKFAST WE ALL WENT DOWN, TAKING THE DOG TEAM”

to say that the pups and “Gladys” were barking at a bear which had clambered upon a small berg off Leigh Smith’s hut. I hurriedly put on my breeches and coat over my pyjamas, and taking my camera and rifle, Armitage and I started off. I sent Wilton on ski with a rifle to get round her and cut off her retreat to the open water if she should get away from Armitage and me.

We found that the dogs had fairly “treed” her but every now and then she made vicious charges down the sloping side of the berg at them. As I approached I took several negatives of her, and when within about forty yards, as she seemed uneasy at our coming up to her and inclined to bolt, I fired, putting a bullet through her head, and she came tumbling head over heels down

the berg making a very pretty sight. She was a young she-bear fully grown and in fairly fat condition.

After breakfast we all went down, taking the dog team with us, including the pups we are breaking in, as

“AND SLEDGED HER UP TO NO. 2 HUT”

we are so short of draught power, and sledged her up to No. 2 hut where Armitage and I skinned and cut her up. I want this meat badly both for ourselves and the dogs. Tinned meat is not as good as fresh for either, and they had been out of bear at the hut for a long time. They had shot no bears during the two months we were away.

I took a number of negatives of sledging the bear up to the hut with the half plate camera.

She had a large quantity of grass and cochleria in her stomach, but no animal matter.

May 20th, Thursday.—There being an improvement in the weather at 2.50 P.M., we started after eleven days spent in refitting and in breaking in some puppies to sledge work, with nine dogs (the five survivors of our late journey, two young bitches, “Miss Råwing” and “Judy,” and two nine-months’ old pups) and a couple of sledges, for the south-east corner of Hooker Island, which I named Cape Cecil Harmsworth, from the summit of which I hope to be able to map in Brady Island and the neighbouring country which is undefined. I was obliged to press these unsuitable animals into the service as I have no others. I trust some dogs will come by the *Windward*, as well as ponies, for use next spring.

All the party started with us on ski to give us a hand over the east glacier; we found the going good as the late thaw had melted the snow, and the ten or twelve degrees of frost we are now getting has frozen a good hard icy crust upon the snow. A rise of temperature would soon convert it into slushy water, however, and in places—in Gunter Bay and elsewhere—there have been large tracts of water standing on the ice. The weather has been overcast, and a threatening sky extends from north-east, through east, to south-east, but with little wind.

We camped for lunch about 7 P.M., three and a half miles south of Camp Point.

I then discovered that the waterproof floor-cloth for the tent had been omitted to be packed. The doctor pleased me very much by offering to return to the hut for the cloth, and if we would camp at Camp Point offered to bring it on before we leave to-morrow morning. I decided, however, to go without it.

When passing Camp Point I went up on to the plateau which is to a large extent already clear of snow,

and made examinations, and looked for anything of scientific interest.

We pushed on across De Bruyne Sound until 2 A.M. when a bear was seen following our tracks and we stopped to give him a reception. He, however, altered his tactics and began to leisurely stalk us, so I decided to spend the

IN MILITZAS

time in putting up the tent and getting our camp ready, keeping an eye on "Mr. Bear" at the same time. He eventually took the same view of us as the fox did of the grapes, and considering discretion the better part of valour, went off towards Windward Island.

I took a round of angles at our evening camp. We travelled twenty-one miles. I soon found that the dogs required me in the traces ahead of them and we reverted to our old method of proceeding. The others returned

to Cape Flora leaving Armitage and me to go on alone.

May 21st, Friday (and 22nd.)—We turned out a little after noon and got under weigh at 3 P.M. The weather had changed for the worse, it was overcast, misty, and snowing frequently, and the newly fallen snow made it sticky going. We, however, pushed on at a good rate for about six hours and then stopped for lunch at 9.20 P.M., with the old depot bearing about N.N.E., distant about four miles. The weather had become very thick and snowy, I however tried a couple of photographic negatives on the coast, extending from the old depot to the western extreme of the typical glacier descending between the rocks on the western side and Cape Cecil Harmsworth. We plodded onward through the snow and dense mist. To the south we could make out May and Etheridge Islands and what we believe to be Newton Island further east.

On approaching the glacier face near Cape Cecil Harmsworth the ice became exceedingly rotten, with water on the surface in every direction extending right out towards the open water, which reaches up from Cape Barents touching Etheridge and May Islands, and appears to come inside Newton Island. There is also a lot of open water off the eastern extreme of Hooker Island and between it and Brady Island.

The ice as we advanced became more and more dangerous, but it was our only road, and I hoped that it would enable us to reach the cape in safety, although every moment I grew more and more uncomfortable. When within four hundred yards of the shore the "Mary Elizabeth" sledge suddenly broke through with both runners from stem to stern, making a large hole around it at the same time. It was kept from sinking by the

dogs in front and the sledge behind keeping a strain upon it. Armitage also went through partly on his ski, but managed to get clear. The ice proved to be only about an inch and a half thick, with three inches of slush and an inch of white snow over that.

This was a very unpleasant predicament to be in. All our food was upon this sledge, and we were far from the hut upon Cape Flora. The ice too was in a most dangerous condition, so much so that when I saw the sledge break through I stepped off one ski to endeavour to haul it out, but found that it was so rotten and thin that without my ski it would not bear me. The great length of these snow shoes (7 ft. 9 in.) distributed my weight over a greater surface. We both felt that if either of us got in there was little chance of his ever coming out again, as all the ice was very thin for a long distance around.

Armitage and I then tried to drag the sledge out by hauling at it upon our ski, but had to desist as the extra pressure put upon the ice during this process so bent it down that the water came bubbling to the surface, and in a few seconds more we should have gone through and joined the fishes.

We then held a short council of war, keeping a strain upon the hauling trace meantime to keep the sledge from sinking. We decided that it was quite impossible to drag it out entire as it was, so set to work to remove articles from the rear, where the ice was somewhat sounder. This Armitage effected by cutting open the rear sledge bag while I held up the bows with the trace. Then came the job of getting at the next sledge-bag which was nearer the centre of the hole. This was no easy matter, but by kneeling upon my ski I managed to get near enough to it to cut it open and jerk the dripping

articles out upon the ice one by one; every now and then having to beat a retreat when my weight, as I reached forward, bent down the ice and brought the water up. Armitage meantime whipped up the dogs to keep the sledge as near the surface as possible and prevent it from sinking altogether. I then cut the straps securing articles to the sledge with a knife tied to the end of my ski-staff and with it lifted off the tent and militzas.

This alteration in the weights on the sledge caused it to turn over on its side, putting the ration bags still further under water. At considerable risk I managed to approach near enough to the front bag to cut it open and get out a tin of tea. I could, however, recover nothing else as the bag of sugar which lay uppermost carried away on my attempting to pull it out. I found it was utterly impossible to drag out any of the ration bags, for when dry they weighed between fifty and sixty pounds each, and now when soaked with water this weight might be multiplied by four.

I pushed the ration bags clear of the sledge with my ski-stick, and then with the help of Armitage and the dogs got the sledge out of the water on to the ice. The ration bags sank to the bottom. We have now no food except a little biscuit, cheese and bacon, which had been put out so as to be handy for lunch, and even this is all soaked with salt water, as likewise our cartridges.

On getting clear all the articles I could save we went back upon our tracks a short distance and I set up the half-plate-camera to take a photo of the scene, but as the dark slides and all my plates have got wet, the weather, too, is very misty, overcast and snowing, and I dare not step off my ski, it was photography under difficulties. There was nothing for it but to retrace our steps as the

ice appeared worse, if possible, towards the shore. This we did with momentary anticipations of a ducking, which would very probably mean a drowning also. The dogs were, of course, awkward and frightened, and immediately stopped on the least difficulty occurring, which was very untimely when fast movement forward was our greatest safety. We reached at last, after a great deal of shouting



AFTER THE LOSS OF OUR PROVISIONS. CAPE CECIL HARMSWORTH

and whipping up of the dogs, a seal hole in the ice which we had previously passed, and at which point we had imagined the ice to be quite sound; but on measuring it at the side of the hole I found it to be only five inches thick with a foot of snow over it. It was the newly fallen and still falling snow, covering thin and sound ice alike with one even white mantle that deceived me as to the full extent of its rotten condition.

In spite of our loss of provisions I felt very loath to return to Cape Flora without completing the coast of Brady and McClintock Islands, so I made a course for the "old depot" intending to camp there and to-morrow

to proceed on ski alone over the glaciers of Hooker Island to the dividing ridge overlooking Cape Lewis-Poole,* Royal Societies,† Brady, and McClintock Islands. By going on very short commons we may make our little food carry us through, but it will mean forced marches and hunger.

On approaching the shore the ice again became very thin and boggy, and I soon found that a wide band of it stretched all along the coast, quite cutting us off from it, and preventing the carrying out of this plan. Owing to the loss of our food and the dogs' also, except a broken bag of a small quantity of their meat, a speedy return to the hut is imperative, and there is no help for it.

I could neither see nor hear a single bird upon the rocks of Cape Cecil Harmsworth, so food could not be expected there, and bears are very uncertain quantities; our cartridges, too, are soaked, so we could not be sure of killing anything.

As we found it out of the question to reach Hooker Island near the eastern end, and not having a canoe, which we are unable to carry with our weak draught power, and consequently had to leave at the hut, we ran very considerable risk of being cut off should we have reached it. I decided after a talk with Armitage to give up Brady Island for the present, and unless the same tiresome arrangements have been made with the captain and officers as last year I intend to go in the *Windward* round there in July when I will get them to put me somewhere upon the southern shore of Brady Island, and a ten-mile ski run ought to show me all I wish

* Named by me after Mr. D. Lewis-Poole.

† Named by me after the club in London which has done so much to aid the cause of science.

to see; from there we shall proceed north up the British Channel.

We now started back on our old tracks, determined to make forced marches and lessen the time of living as much as possible upon salt, wet biscuit, and dog meat. It is poor sledging fodder. On reaching our luncheon camp at 8.15 A.M. of the 22nd we stopped, roughly put up the tent, cooked some dog meat, and dried our handful of soaking biscuit. We then pushed on again. The dogs went well with their weights reduced by about three hundred pounds. At 4.15 P.M. we passed our camp of the morning of the 21st, and as we were going well, and were still fresh in spite of our long tramp we pushed on for another mile and a half, raising the ice face around Camp Point. We then camped and tried to dry some of our soaking equipment.

I stopped twice when the mist cleared during our march, and took a round of angles.

We have travelled since we left our morning camp of the 21st forty one and a half miles, and marched for twenty-five and three quarter consecutive hours, so we are in capital training. We camped to the north-east of Camp Point.

We feel much disgusted at not being able to finish this small corner of Franz Josef Land this season. This is the second time we have been stopped here, and from the same cause. It is a wet spot.

May 23rd, Sunday.—We packed up, still feeling very hungry, after a good sleep and a small feed of the little that remained of our wet biscuit and dog meat, and made for Camp Point. I took a round of angles and a number of negatives with my quarter-plate camera, all the half-plate films are soaked. I went up on to the plateau at Camp Point and looked around again for anything to

collect. I got some moss and other vegetable matter, in which to search for small animal life, and hunted for anything of geological interest but without much success. I saw no indication of this being a raised beach.

The plateau is about two hundred feet high with the ice slope running down on either side of it. Numerous

F. G. JACKSON MAPPING

Ringed seal holes were to be seen in the ice of the small bay, which must have been kept open all through the winter by these animals. I measured the thickness of the ice in one, finding it to be a little over three feet. The current runs very fast to the southward through Miers Channel which accounts for the thinness of the ice.

We pushed on towards Cape Flora with a thick mist and signs of bad weather coming on, and as we ascended the east glacier it began to blow from the north and to snow heavily. We ran down the east glacier near the

Gully Rocks after putting a break on the sledges, and reached the hut a little after midnight covering over twenty miles to get back. I found that the doctor and Bruce had left for a short expedition to Bell Island and Cape Forbes.

I am looking forward to doing a lot of good work in the ship when she comes, soundings and dredgings in the fjords can be easily accomplished, as well as much geological and geographical work. I trust the advice I sent home may produce the desired effect of having her placed at my disposal this summer for a few weeks.

of

arms

raits

I.

CHAPTER XXXI

HOW WE KEPT THE QUEEN'S JUBILEE

May 24th, 1897, Monday.—We arrived back at the hut at 12.30 A.M., having done ninety-two miles in three marches. It was snowing heavily, with thick mist, as we ascended the east glacier from Gunter Bay. We had some food directly we got back, as we felt simply ravenous after our scanty feeding and long marches, and then turned in and slept the clock round like rocks. We never enjoyed sleep more! Armitage and I got our gear, which was soaked with salt water, into the hut, and hung it up to dry. I then set to work to develop negatives taken on our journey to Cape Cecil Harmsworth, which I am agreeably surprised to find undamaged, although all the unused plates and films are spoiled.

As we were on the point of having dinner about 9 P.M. a bear appeared at the flagstaff, no doubt attracted by the waving Jack hoisted in honour of the Queen's birthday and the sixtieth year of her reign. We had spent nearly three years up here, only once having had communication with the outer world in all that time, and were not very certain of the dates: still we did know it was about sixty years since she ascended the throne. The dogs, however, scared the bear before we could get a shot, and although I followed him as far as the big berg to the south-west he soon increased his distance from me and took to the open water.

We had a bottle of the little that remained of the few bottles of champagne sent us last year, for dinner, and rum and milk afterwards followed to drink the Queen's health. Her birthday no doubt has been kept by us further north than anywhere else in the world.

We feel *especially* loyal to-day, and we are all gratified that we have been able to give her name—Queen Victoria Sea—to the frozen ocean to the north of these islands.

I proposed the toast "The Queen, God bless her," which we drank with enthusiasm.

The climate is very Arctic here, but no warmer or more loyal hearts can be found than amidst the snows and ice of this silent frozen land of the North. May her flag extend from pole to pole!

Winds N. 1 to 2 (4 P.M.), E. 1 to 2. Sky clouded $\frac{4}{10}$ ths to $\frac{9}{10}$ ths. Overcast (all but $\frac{1}{10}$ th), misty, and snowing at 8 P.M.

Wilton this afternoon and evening has been much troubled with snow-blindness, and his eyes are weeping very badly but without much pain.

Armitage and I have not been troubled at all, and even when sledging we found no need to wear goggles.

May 25th, Tuesday.—I set Wilton to work again at the bear-skin in No. 2. His eyes are now nearly all right. I did a variety of odd jobs and in the afternoon I made a number of silver prints from negatives recently taken. Armitage cleaned of rust some of the articles taken on our trip to Cape Cecil Harmsworth.

The doctor and Bruce returned at 9.30 P.M.—both very snow-blind, which had brought their trip to an end, and looking very down-on-their-luck indeed, poor chaps! They had camped in the hut upon Bell Island for twenty-four hours, closing up the windows to keep their eyes in darkness until they were well enough to

return to Cape Flora, which they did directly they were able.

HOLE IN THE FLOE FOR COLLECTING MARINE LIFE

May 31st, Monday.—Bruce went out to the hole in the floe, where the ice had been stocked through (ice five feet thick), near the large berg, and took up his trap-

net. He got a new fish (*Cyclapterus*) with a sucker upon its under surface and several urchins, worms, and star-fish. We have now three species of fish, all of which are very small. I have seen none in the water since we arrived here. And all the fish we have collected have been obtained by shooting looms bearing small ones in their beaks, with the exception of the capture to-day.

June 2nd, Wednesday.—All went for a short walk this morning. I went on with my photography. Armitage entered up the workings of the astronomical observations for position taken on the late sledge-journey round Western Franz Josef Land.

June 4th, Friday.—I went out to the hole in the floe made to collect marine life, and devised a net to set there. The doctor and I went for a ski-run to the top of the east glacier after tea.

Wilton went on straightening up No. 1 hut and in clearing snow and ice out of it. The doctor worked at the bear-skins. Armitage wrote up the magnetic observations.

June 5th, Saturday.—Bruce went down to the hole on the floe to examine his traps, and I sent Wilton down with him to lend a hand in putting more planks around the hole to render the edge safer. He then worked with the microscope upon the drift-wood I brought back from the coast of Western Franz Josef Land. He found a new worm in it to-day. I began to make my new map of that portion of the country from bearings I took during our late sledge-journey.

June 7th, Monday.—After I had done my usual morning's work I went out to the hole on the floe and helped to collect marine life, and then went on to the water's edge, where we used the drag-net for the same

" I COULD SEE NONE BUT DRIFT-ICE "

purpose. Among other life a new shrimp (large) was taken in the trap to-day. I continued making my map.

Bruce found further life in the drift-wood that I brought back from north-western Franz Josef Land; among others a snow-flea (dead) and water-bear (*Tardigrada*), the latter of which is new for Franz Josef Land.

It is remarkable how these lowly organised animals can stand the severe cold of winter.

June 8th, Tuesday.—After breakfast I went up the talus and shot nine looms, which are enough for dinner for two days. The spots that are bare of snow are still very hard and slippery, making climbing difficult and rather risky. I had to cut steps after going half the way up. I could see none but drift-ice to seaward beyond the land floe from the top of the talus.

Bruce, after going as usual to the hole on the floe, worked at the zoology with the microscope. He found to-day a new diatom amongst the drift-wood I brought back from north-western Franz Josef Land.

The kittiwakes are now building, and I noticed that the buntings had paired several days ago.

Winds N.E., force 4 all day. Sky clouded $\frac{7}{10}$ ths to $\frac{8}{10}$ ths.

June 9th, Wednesday.—After breakfast the doctor, Wilton, and I harnessed up the dogs to a sledge, and went round to the north end of Windy Gully to bring to the hut the fellow to the large whale's jaw bone I sent home last August. I carried the half-plate camera, and took two or three telephoto views of Windward Island and Camp Point. The snow was very cloggy, making the sledge and our ski run heavily. We got back at 7.30 P.M. We ascended the glacier that runs off the rocks of Cape Flora to examine a bare spot on which is

earth and broken pieces of basalt. We found it to consist of moranic material, and could find no other fossils but one lump which appears to contain plant remains.

Bruce went on with his zoology. He got a new large shrimp in the trap this morning (22 specimens), two pieces of coral (white), and another large shrimp like the one obtained yesterday.

Armitage shot a Lapland bunting (female) this morning. Two Brent geese were seen to fly west soon after breakfast, so I sent Wilton after them with a gun. He succeeded in shooting one. Two more geese were seen to fly east over the floe later in the day. Verily this is summer!

June 11th, Friday.—We tried a quantity of the small species of shrimp, which are daily obtained in the net, curried for dinner to-night. I cannot say that they were satisfactory, being very tasteless and all shell. They were very like wheat husks and not much larger.

Bruce at my request is taking a series of observations with Buchanan's hydrometer to ascertain the salinity of the sea water here. The formula for working the results out has, unfortunately, been forgotten to be sent out, so that will have to be done at home.

June 12th, Saturday.—There is every appearance of the ice in Nightingale and De Bruyne Sounds having broken up. This has occurred much earlier than in preceding years.

We were all weighed again this evening. Armitage has gained 11 lbs. since we returned from sledging in May, and I 9 lbs. (present weight, 13 stone 4 lbs.). The others have all lost from one to two pounds each since the last weighing.

Winds E. 6, E. 5, E. 3 to 4, S.E. 3 to 4. Overcast and misty all day.

June 14th, Monday.—As the day opened sunny and clear—a great rarity—after doing my usual morning's work Wilton and I harnessed up the team of five dogs, and taking a sledge to carry my photographic equipment, we went out to the "photographic berg," where I took a series of panoramic views and several other negatives. After tea we took the dogs and sledge and went to the top of Cape Flora by the west glacier, where I took a number of bearings and tried to locate Peterhead more exactly, but without success. I took a number of negatives, but a strong wind and mist constantly coming over the summit rendered good results rather difficult. We had a fine ski run down again as the snow was frozen the greater part of the way, making the running fast. I brought the maximum and minimum thermometers which I had placed up there last October with me, as the maximum is useless, for there is nowhere up there where it is possible to keep it out of the sun, and the minimum had become disorganised.

There is a large extent of open water around Windward Island, and Gunter, Bates, Nightingale, and Miers Channels are practically open—long streaks of open water occurring at frequent intervals along their courses. There is much ice in the sea from S.S.W. through south to east, but from south-west to west there is very little, and the sea is quite open in that direction as far as the eye can reach.

Armitage gave the *Eira* boat a coating of oil and went on with the magnetic observations.

The thermometer rose to-day as high as 43.5° F.

Winds E.S.E. 2, E. 2, E.N.E. 2, N.E. 4 (increased to force 6 to 7 in the course of the evening). Sky clouded $\frac{7}{10}$ ths at 8 A.M., but cleared all but from $\frac{3}{10}$ ths to $\frac{2}{10}$ ths the rest of the day.

June 18th, Friday.—The wind had died down this

morning, and as it remained sunny and the mist had cleared off the glacier, Wilton and I started off with a

DR. KOETTLITZ AND MR. WILTON

sledge and five dogs to drag my camera, to ascend the high ice-dome behind the Gully Rocks from which the east glacier derives its ice, to take negatives.

The day was clear and sunny, and the horizon in every direction quite devoid of mist, and visibility was great—most unusually so for this part of the world. I could see north as far as Cape Fisher; Scott Keltie Island, Eaton Island, the Rubini Rock, and the coast of Hooker Island stood out clearly, as also did the western shores of the British Channel. I could see the whole of the coast line of Alexandria Land bordering up Nightingale Sound except a portion in the neighbourhood of Essen Bay, which the high whale-back of Bruce Island covered from view. The height of the ice-dome on which I stood is about 1500 ft. We found a rather nasty crevasse on the summit covered with snow, and when descending from the dome Wilton partly got into one about five feet wide, which I had just run over on ski without discovering. The back part of his ski broke the snow bridge, and he had a narrow escape of going backwards into it. These crevasses are completely concealed by snow, and there is absolutely nothing on the surface to indicate their presence. This I have found to be generally the case in Franz Josef Land, although on certain parts of the glacier covering Hooker Island very slight depressions in the snow running along the course of the crevasses sometimes indicated their presence. This is probably caused by the frequent gales forming a quite even snow bridge over them.

I took eighteen negatives and shot four rotges. We got back to the hut at 8.30 P.M.

June 20th, Sunday.—I was awakened at 5.15 A.M. by the loud barking of the dogs. I put on a pair of boots, and a coat over my pyjamas, and taking my hand camera and rifle went out, as the barking indicated that a bear was outside. I found him close to the hut on the snow bank by the enclosure. I took ten negatives of him at

distances varying from fifteen to six yards, and having used up my films I shot him through the jaws, aiming at his head, the bullet passing backwards, and cutting open his throat. As the brain was uninjured, he made off towards the floe, and I put a bullet into his right shoulder near No. 3 canvas hut. This, however, did not stop him, but

A VISITOR AT OUR HUT

as he was on the point of disappearing down the steep slope on to the floe by No. 1 hut I put a third bullet into his neck at a distance of a hundred yards, which broke his backbone, and stopped all further progress. He was a good sized he-bear, with a stomach full of grass.

I turned into my blankets again for an hour or two. After breakfast we flensed the bear and cut up the meat. I took six negatives of the fleshing party and the same afterwards on ski. I then developed these, and the ones I had taken of the bear, all of which (three-quarter plates excepted) turned out remarkably well. The others went for a walk and amused themselves in a

variety of ways, it being the Sunday holiday. A new shrimp was obtained to-day.

Winds N.N.W. 2, N.N.W. 1 to 2, N.W. 2, N.N.W. 2. Sky clouded $\frac{8}{10}$ ths to $\frac{1}{10}$ ths. Mist hanging over the high land most of the day.

June 23rd, Wednesday.—Wilton began to dig out the whale boat from the snow drift in which she is buried. The doctor went on with the walrus heads.

Winds S.E. 1 to 2, E. 2, 2, W. 1 to 2. Sky clouded $\frac{2}{10}$ ths to $\frac{7}{10}$ ths. Misty until afternoon, when it and the sky cleared.

June 24th, Thursday.—After breakfast Armitage and I fitted up the trawl, and then he, Wilton, and I took it and the rest of the gear on a sledge to the west point. Here Bruce joined us, and we trawled from the boat, using the dogs for towing, until after 6 P.M. Ice coming down Miers Channel bothered us a good deal. We got nothing new, and no fish, which I had hopes of doing. I shot two terns—the first seen this summer—which I am keeping as specimens.

Bruce worked at the zoology. He got a new fish, about nine inches long—a species of *gaddus*—in the trap to-day, and also a star-fish (true, not a brittle-star.)

June 25th, Friday.—To-day I began photographing the sketches (biological) Bruce has made since he has been here. I then developed them. This is to guard against possible loss of the sketches. I am also making a collection of photographs of the birds here.

June 26th, Saturday.—I have been hard at work all day photographing the rest of Bruce's biological sketches and about half a dozen birds. Just before dinner I went for a short walk with the doctor to Sharpe's Rock. Armitage did one or two odd jobs about the place.

June 28th, Monday.—About 2 P.M. a bear was seen stalking Bruce, who was at work at the hole on the floe by the photographic berg. As Bruce did not see him

at first, I started off on ski with my rifle, followed by Armitage and the doctor with rifles. On Bruce catching sight of him "Mr. Bear" made a circuit behind some hummocks, but seeing us in pursuit, and as Bruce shouted unfortunately, he made off towards the water's edge. Armitage and the doctor returned to the hut as the floe is very bad walking, but I followed in the bear's track's and might have got within shooting distance of him, but unfortunately Bruce again shouted to me from the top of a berg, which scared him, and he took to the water and made for an ice piece, which he again left on my walking to the edge of the floe, and swam off towards some floating ice about a mile off. We want bear meat badly.

On my return I went on developing negatives. Armitage is lashing up a bamboo ladder for me to get eggs off the rocks with. The doctor did several odd jobs in the house, mixed the ingredients (or rather those that we have) for a plain cake—very plain it was too, but very acceptable for all that. Wilton collected all the old torn coal sacks and placed them on the boulders to dry. We shall have to use them as fuel next winter if we get no more coal from the *Windward* this summer. I do hope draught power and a few stores will come out for our push north next spring.

We have been quite out of all sugar for some time past, owing to our having to supply the *Windward* when she wintered here.

My experience confirms the view of Professor Vaughan Harley that sugar should not be looked upon as a mere condiment, but as a most valuable food, increasing the power for muscular work. He found by experiment that 26 to 33 per cent. more work can be done when $17\frac{1}{2}$ ounces are taken, than by the same person when

ARCTIC VEGETATION, A BED OF POPPIES

he omitted sugar from his day's food. Even the ordinary addition of sugar to the usual full diet caused a marked increase in muscular power.

Numerous independent individuals have shown how, both in hot and cold countries, there is a natural craving for sugar when much muscular work has to be done. Professor Vaughan Harley mentions some of these in an interesting paper in the *British Medical Journal*, and Surgeon-General Sir William Moore says that the natives of India when on long journeys give their horses and camels molasses (sugar) to sustain them. Certainly from my own experience I felt the want of sugar considerably. The desire for sugar almost becomes a craving here.

I saw a small tringa to-day sitting near the pond by the hut, which struck me as being an uncommon species. I called Wilton out of the hut to shoot it, which he did. I am preserving it for examination by an expert. Its light colour and smallness caught my eye, as being different in appearance to the purple sandpipers common here, and led to its death.*

June 29th, Tuesday.—Wilton fastened all the pups up with collars and chains to a rock behind the hut near the older dogs. I wish to keep all the dogs carefully secured, so as to be able to quarantine any arriving by the ship, and so prevent the introduction of disease by them.

July 1st, Thursday.—It is almost three years since

* I understand from Mr. Eagle Clarke's report that this bird is a female Bonaparte's sandpiper (*Tringa fuscicollis*). It was alone, and the only example I noticed in Franz Josef Land; but owing to a somewhat close resemblance at a distance and on the wing to the *Tringa striata* it is possible others may have escaped observation through being mistaken for these birds. This bird is a new and remarkable addition to the series of Franz Josef Land. I understand from Mr. Clarke that it is also the first example of this American species that has been obtained in Europe elsewhere than the British Isles.

we left home, and only once have we heard anything of the outer world. One longs for news and yet almost dreads it too.

I had arranged to go out with Bruce in the *Eira* boat dredging, but ice drifted into the bay and cut us off from the water. We saw two walruses lying on a lump

WALRUSES ON AN ICE-PIECE

of ice near the west point of the bay. I started off with my rifle, and Wilton and Bruce brought on the little boat on the sledge with the team of dogs. By crossing several lanes of water and hauling the boat over pieces of ice Wilton and I got within sixty yards of them. I succeeded in killing one, and secured it in the water. We towed it behind the boat back to the slope below the flagstaff, as the ice had in the meantime sufficiently opened for us to force the boat through. Wilton spent the rest of the day in flensing it and cutting up the meat for the dogs. The second walrus disappeared at the first shot."

As the ice was too troublesome for dredging, I

carried the bamboo ladder to the top of the talus with Bruce's help, and got twenty-eight loom's and twelve kittiwake's eggs. Bruce collected specimens the meanwhile of small land life. He has now three species of flies. The doctor went to the Gully Rocks geologising. He found some black lignite *in situ* overrun by the

DREDGING IN OUR WHALE-BOAT

basalt. Armitage wrote up the meteorological observations and took an observation for time.

Winds W.N.W. 1 to 2, N.W. 0 to 1. Calm. Sky clouded $\frac{1}{10}$ th to $\frac{2}{10}$ ths.

July 5th, Monday.—As the day has been beautifully calm and bright, I first of all photographed my map, as a protection against loss, and then took a number of other negatives and developed them. Going outside the house after dinner with Armitage, who had his binoculars with him, I heard a strange cry of a bird (somewhat like an ivory gull's), and looking up into the air I saw, flying some hundred feet up between the hut and the rocks, what I believe to have been an adult Ross's gull (breast and

neck a bright rosy colour, becoming less marked towards the tail). I could not get a clear view of the tail, owing to the position of the bird, to ascertain if it was wedge-shaped. There were no other birds near it when first seen, but it was quite alone. The under tips of the wings were strongly marked with a dark colour. I could not see the upper surface of the bird's body or wings. We called out to the others to come out of the hut at once to look at it, but they arrived too late to see it. I went in and got my gun, and calling Wilton to follow me with his, left Armitage to keep an eye upon it with his glasses. We ascended the talus, as he had viewed it towards the second tier of rocks, where it had flown amongst some kittiwakes, and although we searched for it everywhere we thought at all likely, I failed to see it again. I shall have another search to-morrow above the first rocks, as it may possibly be nesting up there. There is no record, I believe, as to what position the Ross's gull chooses for its nesting-place, as up to the present it has never been discovered.

July 6th, Tuesday.—After doing my work about the house, I took my gun and climbed the talus in the hopes of coming across the Ross's gull. I clambered along above the first tier of rocks for some distance and searched high and low, but failed to see it. I rather think that it may be nesting near Cape Flora and only came here for moss if this gull uses moss in making a nest, for last night I was inclined to believe that a bird I saw flying west with moss in its beak was the Ross's gull I had previously seen, but the distance was too great to be sure, especially as there were numbers of other birds about. I looked the rocks over closely for some hours, but without success.

I have requested Bruce to take six samples of sea

water off the shore here for analysis at home. He got a new crustacean and brittle-star to-day. Our collection of minute life will be a good one, I think. Fisher did very well, and every one has done his best to add to it.

July 7th, Wednesday.—This morning I saw through

F. G. JACKSON WALRUS-SHOOTING FROM HIS BIRCH-BARK CANOE

the mist a walrus on a piece of floating ice beyond "Bear Berg." As the *Eira* boat is away at West Point, I had to go off in my birch-bark canoe, which is a bit cranky for walrus shooting. I paddled out about a mile, but something frightened the animal, and it slipped off into the water as I approached.

Armitage, on going out immediately after dinner about 9 P.M., came in to say that the *Windward* was to be seen to the south-west. We saw a steamer about six miles off, but heading to our surprise, towards Mabel

Island. The fog came down thick, and when it cleared she was seen "lying-to" about the same distance off. She has arrived earlier than I expected, but she might have got here, so far as we could see, three weeks ago, if she had started early enough.

We all went down and got out the whale boat ready for launching, and Armitage and I went round to the West Point and brought round the *Eira* boat for our use in going on board the ship.

Winds N. 1 to 2, N.W. 1 to 2, S.E. 1 to 2. Sky clouded $\frac{1}{10}$ ths to $\frac{1}{8}$ ths. Misty all day.

July 9th, Friday.—About 1.30 P.M. Armitage went along the plateau west to see if the ship was anywhere visible up Miers Channel, as her apparently strange conduct of disappearing for thirty-six hours puzzles us very much. The doctor and Bruce followed him, and later on they saw her round the west point, and as I was told she was lowering away a boat, I also strolled down towards it, as I expected the mails to be sent ashore in her. To my surprise I found a strange boat on the beach, and learnt that the ship which had again disappeared up Miers Channel was the *Balæna* of Dundee, under the command of Captain Thomas Robertson, which had just left East Greenland, having done the passage here under steam in twelve days (eight days from south end of Spitzbergen). She had come to hunt for walruses. It seems that some one from the *Windward* in 1896 had spoken of the large number of walruses to be seen here, and of the probability of its paying to take them. I have a different opinion upon that subject. The appearance of the ship at a distance is very like the *Windward* and we certainly expected to see no other, so we did not examine her carefully.

Capt. Robertson had sent a message asking me to

come on board, so all of the party who had come down went off in the boat. Captain Robertson told us all the news he could prior to April. How the *Windward* had reached Vardo in six days from here last year, and the *Fram* had

CAPTAIN ROBERTSON

got home and arrived at Tromso a few days after Nansen had got to Vardo, and how he had met her there. About the Greco-Turkish war, and Andree's disappointment in starting last year, and his proposed renewed attempt this summer in his balloon. He could not, however, give us any news of our friends. It came on to blow with rain and dense mist, so the *Balena* steamed up Miers Channel and anchored to the land floe off the north end of Windy

Gully for protection. We were obliged to remain on board all night owing to the badness of the weather, which we were not loath to do, for nothing could exceed our host's kindness and hospitality, it was very delightful to see new faces again, and hear a little news

THE NEST AND EGGS OF RICHARDSON'S SKUA

of the outside world. We slept upon the cabin floor in our clothes.

July 10th, Sunday.—The weather has much improved this morning. The engineers were engaged all day up till 3.30.P.M. in repairing the condensers, so we had to remain where we were, but that having been done, the *Balena* steamed to the west point, and we went ashore in a whale boat. Robertson kindly gave us a bushel of potatoes and about a peck of onions, which are very acceptable. I advised him to try Gray Bay for walruses, and he later on steamed off there to do so, intending to

return to Cape Flora on Monday or Tuesday, when he will look us up. I am supplying him with a tracing of my 1896 map (slightly altered about Peterhead), as he speaks of going up the British Channel for walruses. He has only a small Admiralty chart of these islands, which is useless to him.

RICHARDSON'S SKUA

His description of Franz Josef Land strikes me as being very apt. He says: "Franz Josef Land consists of two black spots—Cape Flora is one, and the other is something else, and you can't see both together." Meaning that with the exception of isolated black rocks at long intervals, all is a white expanse of snow and ice. He is anything but enraptured with the appearance and climate of this part of the world.

July 11th, Sunday.—Armitage and the others after

they had returned from their walk told me they had found the Richardson's skua's nest, the vicinity of which I had marked on Friday by the behaviour of the parent-birds, and which I wish to photograph if it be found. I at once started off west with the camera, and took several negatives of the nest with the eggs in it, and also views of the birds. After my return I developed the films.

After dinner the mist lifted somewhat, and I saw to the southward some walruses on the edge of the ice. As I wish to give all my companions each a head with good tusks, and we want some meat, we manned the *Mary Harmsworth* and started off to get them. I took several negatives of them as we pulled up, and then opened fire.

Armitage and I killed all upon the piece of ice, with the exception of one which slipped off into the water as we came up. As we were taking the heads off upon the small ice piece, a large bull walrus came up bellowing with a determined rush and clambered upon the ice, evidently with the intention of "going for us." I got my rifle out of the boat, stopping him with a bullet in the head within three yards of us, and he fell back into the water. One of the men ran to the edge of the ice and fixed a seal club in him, but the walrus gave a spasmodic struggle and wrenched it out of his hand, and nearly pulled him into the water. He then sank quickly, taking the seal club with him unfortunately.

We towed one walrus back for dog meat, which was the most we could manage, as we had a long way to pull back to Cape Flora. My fellows drew lots for choice of heads when we got back. It is a pretty sight to see the cows with their cubs, holding them with their fore-flippers, and sometimes swimming on their backs, carrying the little ones by clasping them with their flippers. A full grown bull is a pugnacious beast, and being ex-

WALRUS ASLEEP ON A PIECE OF DRIFTING ICE

ceedingly large and powerful, is apt to be dangerous. He enjoys a fight, and will go out of his way to have one.

Walruscs disgorge the stones they have swallowed to aid digestion, and also the shells of bivalves, and I have frequently found a small lot of pebbles and shells on the ice where walruscs have been lying. There was nothing

CUTTING UP A WALRUS

in the stomachs of those we killed to-night, and they were very much contracted, probably to eject stones and shells from it after the digestion of food is completed; there were small heaps of stones and shells near them. The doctor found a baleen of whalebone 6 ft. 2 in. in length near the west point, thirty-three feet above sea-level.

Winds E. by S. 3, E.S.E. 2, N.N.W. 0 to 1. Overcast and misty all day.

July 12th, Monday.—I spent the day in doing several odd jobs and in making a tracing of my 1896 map, altered

on the western shores of the British Channel, so as to be in no way misleading, for Capt. Robertson, as he has no map of Franz Josef Land of the smallest use to him, and has asked me for a copy.

ONE OF OUR PETS (A YOUNG WALRUS)

I gave Bruce the walrus we towed in last night, as he wishes to have it for purposes of comparative anatomy, and he and Wilton have been engaged all day in cutting the meat off the skeleton. Bruce and I examined the intestines to-night for any parasites. We found very small pieces of basalt and pieces of shell, but nothing else. The gut was over fifty feet long.

July 13th, Tuesday.—After breakfast I walked down to the skua's nest and took several negatives of the birds and brought away the eggs. Bruce went along

the shore to the east with the *Eira* boat tow-netting and dredging, and I sent Wilton to help him. The doctor went up the talus to the westward geologising.

When I returned from the nest I saw a walrus lying on a piece of ice to the south. As I wished to get a

ONE OF OUR PETS

head for Wilton and some more meat, we manned the whale boat, and taking my camera, pulled out to it. We succeeded in killing two others, which, however sank, and captured alive a young cub (male) by jerking him out of the water with a seal club into the boat, where he flopped and floundered about, and we had great trouble in keeping him on board. After a time he settled down and took things more easily and made himself quite at home. We towed the she-walrus we secured

ashore near No. 1 hut. I photographed the cub at the hut several times. I have lodged him in the barometer house, and am trying to feed him on milk from a bottle. He has grown quite accustomed to us in this short time, and shows little fear. He is quite uninjured. His weight is one hundred and eighty-seven pounds—not bad for a youngster!

Armitage took the height of Cape Gertrude to-day with the theodolite, making it 1220 ft. to the top of the ice dome, and the highest ridge of rocks 1057 ft. This differs somewhat from previous results.

July 17th, Saturday.—As we had got quite upside down so far as night and day is concerned, I determined to try and put it right by sitting up for twenty hours and not turning in until late in the afternoon on Sunday, so as to get a fair start with the Monday.

I did a variety of odd jobs. Developed my negatives taken yesterday, and continued writing my letters to send home by the ship.

July 18th, Sunday.—The doctor and I devised a feeding bottle for the walrus out of a football bladder, and a large tube I got from him to form a nozzle. He is a very troublesome animal to feed, as he will neither suck nor drink; everything has to be forced down him, and the feeding bottle we have made is practically a stomach pump which answers admirably. Robertson told us on Friday that the two they have on the *Balæna* have had nothing at all (it is a week since they were captured) as they find it impossible to feed them. They are, however, still alive, and appear to be quite well.

Capt. Robertson tells me he has seen two very small rocky islands just to the north of Cape Barents, and has asked me to include them in my map. This I have done, naming them the Robertson Islands.

A CAMP IN SUMMER (ON THE COOKE ROCKS, AUGUST 7, 1895)

CHAPTER XXXII

UNEXPECTED RETURN OF THE EXPEDITION

July 22nd, 1897, Thursday.—About 9 A.M. this morning the mist lifted, showing the *Windward* lying a little to the south of Cape Gertrude, where she had been for some hours, but had been unable to proceed owing to the thick weather. As she seemed inclined to approach the shore of Cape Flora on the eastern side, where the water is shallow, I sent Armitage and Wilton off in the *Eira* boat to pilot her round to the west of the flagstaff. The letters were brought on shore, when I learnt the sad news of my mother's death, which had occurred just before the *Windward* sailed. I have lost the best mother that any man could be blessed with. A mother with whom self was never considered, a tender, gentle, courageous, self-sacrificing woman.

I received amongst our correspondence certain communications, which, together with the fact that no draught animals have arrived, leave us, I fear, no option but for the Expedition to return to England.

I learn also with regret that the arrangements made in London in connection with the *Windward* will also prevent my utilising her for exploring purposes.

I had wished next spring, having completed the mapping in of these islands, to push as far north as possible by exploring to the west of Nansen's route, and the use of the *Windward* for a week or two this summer would have made the scientific results still more complete.

It is much against the grain that I leave a single item in my programme in any way not fully completed. When I undertake a work, I like to see it through to the fraction of an inch.

On receiving these letters I called my men together,

THE "WINDWARD" OFF CAPE FLORA

and informed them of the position. As the result, I fear there is no alternative but to return.

Several of the crew of the *Windward* came to me to-day and applied to join my party, but under the circumstances I am unable to accept their services.

The *Windward*, under Captain Brown, made a remarkably quick passage under sail to Vardo when

returning with Dr. Nansen and Lieutenant Johansen last year, being favoured by strong northerly winds and

SNOW BUNTING'S NEST ON SHARPE'S ROCK

a sea very free from ice. They did the passage in six days.

July 23rd, Friday.—To-day we have all been busy packing up our collections to be sent by the *Windward*. I have been turning the situation over in my brain all day and night to endeavour to discover some method by which I can still carry on the Expedition; but can think of none.

I had a talk with Captain Brown to-day, pointing out to him the advantages that may be derived, and at very little risk to the *Windward*, of steaming round Cape Mary Harmsworth, and from there north-west, to confirm my belief that Gillis Land has no existence in the spot assigned to it upon the maps. For I know how hard land dies, when once supposed to have been seen, and I wish to prove the non-existence of this much-discussed and very mysterious country beyond the doubts of even the most sceptical, although I feel quite satisfied about it as the result of last spring's sledge journey. Dredging and sounding can be carried on during the voyage, and much good work done. After satisfying every one it may interest in reference to Gillis Land, I propose that we shall steam south, and on our way home make for the islands said to have been sighted by Captains Johannesen and Andreassen in 1884 off the east coast of Spitzbergen; and should they be found "at home," to land upon them and make examinations and collections. I find Captain Brown most willing and anxious to do his utmost to help me in any way in his power, and it is due to his good nature and enterprise that I have been able to arrange with him to carry out this programme, which, however, will not take the ship far out of her homeward course.

I photographed this morning a clump of fungi upon the raised plateau of Cape Flora, which Fisher since his return home has reported in a letter to be "new to science,"

and we have gathered all we can of it, preserving the specimens in spirit. Mr. Fisher reports to me that this fungus

TRICHOLOMA CAESPITOSUM MASSEE, N. SP. (MASSEE IN LITT.) FUNGUS, "NEW TO SCIENCE,"
DISCOVERED ON CAPE FLORA

has not been found elsewhere in Franz Josef Land. It was discovered in two spots on this Cape. The first at

an altitude of about 40 feet above the sea, growing in clumps in a dry peaty soil of dead moss, and the second a little further west and at an altitude a few feet higher.

Nansen has very kindly sent me, as a present, a couple of canvas canoes for use in sledging. These, he tells me, were made under his own personal directions. It is very good of him to think about it considering how busy he must be just now. He has sent to each of us a copy of his book, which is nice of him. I have, however, been too busy to glance at it yet.

July 26th, Monday.—For days I have searched for any possibility of continuing the Expedition, but can find *none*; there is no help for it but to return, and having decided to do so, there is only for us to pack up with all possible speed, collect our specimens, put stores on board for our use, and get under weigh.

Every one has been busy getting stores on board the *Windward*, and articles are being stowed away in packing-cases at express speed as they come to hand.

This evening when returning from the ship in a small boat a young walrus popped up its nose alongside. In a moment I had secured a seal club in his tough little hide, and before he had realised what had happened I had jerked him out of the water and into the bottom of the boat, where I threw myself upon him and held him down to prevent him going over the side into the water again. He struggled, grunted and flopped about, and it was with the greatest trouble I could retain my hold of his slippery little coat. After a time he became more reconciled to his position and his struggles relaxed. The sailor I had with me then paddled the boat to the shore from whence it took five of us to carry him up to the hut—he weighed nearly fourteen stone—in some sacking, where we lodged him with our previous capture of that ilk, and the two

now grunt in chorus in the barometer shed. I hope to be able to get them both home to the Zoological Gardens in London. He is a trifle older—or at all events larger—than the first baby walrus we secured. We are feeding this little chap also with the stomach-pump, as apparently in common with his new chum he does not understand

THE BABY AND HIS NURSE OUT FOR A CONSTITUTIONAL

any less advanced system of feeding, but evidently they both consider it a great improvement upon the one their mothers adopted, as it saves them the trouble of swallowing, and they take their condensed milk now that way as a matter of course.

“Puggie,” the one we captured some time ago is now quite at home, and is a most sociable and intelligent little beast; unlike our little friends, the bear cubs, his manners have improved since he took up his residence with us, and he is now a very much respected and respectable member of our small community. Every day he is let

out of his pen and shambles about with that awkward walk peculiar to his race upon the plateau behind the hut, until his nurse, Mr. Wilton, considers that he has taken a requisite amount of exercise, when he is fed and put to bed again. He is a great pet of mine, and he on his part is most friendlily disposed towards me.

July 27th, Tuesday.—We have been busy packing all day. Captain Brown sent three men from the *Windward* to help me this morning, and later on two more. We have now got a lot of goods on board.

I sent Wilton up the talus to shoot looms for the voyage home.

The *Diana*, which has followed the lead of the *Balæna* by coming up here, has, up to the present, only twenty-five walruses, but the latter has taken about five hundred and twenty-five in all, which, together with the whale she took in East Greenland, will pay her. Thus our Expedition has been of profit, commercially, already.

August 1st, Sunday.—It blew hard from north-west the greater part of the day. A large quantity of marine life is washed up on the shore beyond the Sharpe's Rock, but having no formaline, it is impossible to preserve some of them. I photographed a jelly fish secured to-day, which had not previously been found here, as being the next best thing to preserving it in formaline.

August 2nd, Monday.—I received a very definite promise from the ships' captains that they will allow nothing to be touched at the hut after we have gone. They also said they would do their best to check any one who attempts to meddle with anything here, and would at once report any such occurrence to me.

Some unfortunate beings may be very glad of the provisions we have left at the hut for any one in distress, and

sooner or later, I have no doubt, they will be the salvation of some castaway or explorers beating a retreat

THE TALUS AND CLIFFS OF CAPE FLORA IN AUGUST

south. Depôts of food should *never* be meddled with in the Arctic, unless there is absolute necessity for doing

so. Depôts of food have been robbed in the past, and deaths have been directly caused by this dastardly act.

FOSSIL TREE-TRUNK *IN SITU*

A man who helps himself to them without legitimate reason may be guilty of nothing short of murder. I am

particularly anxious to protect the stores left here for possible use by Andrée.

POSITION OF THE FOSSIL TREE-TRUNK ON CAPE FLORA (INDICATED BY DR. KOETTLITZ)

August 3rd, Tuesday.—I sent the doctor, with Heyward to help him, to bring down the talus, the fossil tree-

trunk which the doctor had found lying under the basalt, *in situ*, about 600 feet up the talus ; the volcanic rock had apparently overrun it, also to collect some more fossils from further east, and to get them on board the *Windward*. Had it been my intention to now go home I might have had some of this work done before.

I packed up a number of articles and took them off to the ship, and stowed them away. Everything is being done with the utmost haste, and things are being pitched into packing-cases just as they come to hand.

I set Armitage to take stock of the stores we are leaving here.

Andrée's friends have sent a number of goods for his use in the event of his being able to reach here ; and to these goods I am adding such things as I think will be useful to him, in addition to a quantity of provisions.

Andrée's own stores consist of eighteen packages (including one canvas boat). Some cases have evidently been opened, possibly by the Customs in London. There is also a cask sent containing some fluid, probably paraffin.

I left in the hut for Andrée, besides provisions—

One rifle and four hundred rounds of ammunition.
Two hundred 12-calibre shot ammunition (central fire).
Twelve pounds of cut tobacco in tins.
About eight gallons of whisky.
Ten bottles of blood tabloids.

J-H. P. E. stores left in the canvas huts—

Eighteen crates of biscuits (56 lbs. each).
One case of salt. A quantity of coal-dust.
Twelve cases of Edam cheese, damaged by frost.
Some casks of Spratt's dog biscuits (mostly spoiled).
Twenty-two cans of boiled beef. One case of boiled mutton.
Fifteen cases of rumpsteak, veal, and tripe and onions.
One case of dried vegetables. Three cases of Cadbury's cocoa.

UNEXPECTED RETURN

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One case of Cadbury's chocolate.

Two cases of butter (Cork and Dutch).

Eleven cases of methylated spirit. Nine drums of paraffin oil.

Four dozen fire-bricks. Two cases of tea.

Three casks of lime juice. Some sacks of coarse salt.

Number of small Union Jacks on 7-ft. bamboos.

Marks F.J.L., J-H.P.E.

August 3rd, 1897.

CHAPTER XXXIII

NO GILLIS LAND

August 6th, 1897, Friday.—We have placed during the day the greater part of the cases that had been outside the hut, together with seventy gallons of methylated spirit, in the stable store, which is locked up and the door also secured with nails. All the outbuildings are nailed up and boards fastened over the windows.

Five cases, also rifle, ammunition, tobacco, butter, whisky, a canvas boat and other articles for Andrée, are placed in the hut together with five bags of coal (the rest of the coal is left on a raised platform behind the hut, which is locked), two spars are nailed across the door, and the windows barricaded with boards. The rest of Andrée's goods are nailed up in the observatory.

About 6 P.M. we left and went on board the *Windward* in the whale-boats. The crews of the boats sang "God save the Queen," and our Jacks waved our farewell from the bows as we pulled away to the ship. I leave my work with regret.

Amid much whistle blowing and dipping of ensigns we steamed off at 7.10 P.M., heading west. Cape Flora was quickly hidden from us by mist, thus abruptly obscuring from our sight our lonely Home, for three years the scene of our varied hopes, fears and ambitions. I feel not the smallest wish to go, with my desires not realised entirely to my satisfaction, and instead of feeling all the pleasant sensations of a schoolboy returning for the

holidays, which we had been anticipating for three years, I experience much the reverse.

We take frequent soundings as we proceed and the tow-net is dragged from the stern of the ship. The water is too deep for the dredge as there is no line on board that will reach the bottom.

WE LEAVE CAPE FLORA

The wind dropped as we arrived off Bell Island and the sun came out. I remained on deck all night taking negatives of the coast as we slowly steamed along. I lay down in my clothes at 4 A.M. and for two hours snatched a short sleep. As we sailed westward the sea deepened. Off the mouth of Gray Bay the lead gave 115 fathoms. A mile off the small glacier running down between the rocks on Cape Crowther 143 fathoms.

The night was beautifully clear and still, the low midnight sun shone brilliantly in the northern sky, lighting up the cold, white, glittering glaciers of Alexandra Land. Our eyes could now follow with ease, as we luxuriously

steamed along, the route Armitage and I with our five surviving dogs had so laboriously struggled along last spring. There to the north-east at the head of Gray Bay is the Peary Glacier* up which we hauled our sledges foot by foot, and there to the north-west at the base of the rocks of Cape Crowther is the spot where bad weather

A ROWDY-DOWDY CREW

kept us cooped up in our tent in wet clothes and rotting furs in the beginning of last May. It is difficult to believe now, with everything sunny and peaceful, that these are the same spots where all was drifting snow, bitter cold, and fiercely driving blizzard. And how we appreciate the comfort of the little cabin below, when we recall our camps upon that ice-bound land, when crouching over our smoky fat-lamp we swallowed our cocoa made with lukewarm water, and devoured our lumps of frozen fat bacon! Eh, and with relish too, that keen appetite alone can give. And yet I long for more sledging, and more discovery.

* Named by me after the Arctic Explorer, Mr. Peary, U.S.N.

August 7th, Saturday.—At 6 A.M. I was called, as we were close to Cape Ludlow. Only a few scattered lumps of ice could be seen in Cambridge Bay. Away, at the head of it, can plainly be seen Cape Fridtjof Nansen, which, from this point, hides Cape Johansen. I had named these Capes after my brother explorers and guests

CAPE CROWTHER IN SUMMER

of last summer. The sea is still exceedingly open and there is practically no ice in any direction. It is a marvellously open season!

We found landing quite out of the question upon Cape Ludlow, as a glacier face fronted the cape all round from twenty to forty feet high, as we had found it in July 1895. So I had to content myself with photographing it instead of fixing a flag upon it, and taking observations for position there, as I had intended. We then steamed on to Cape Lofley where we found the conditions exactly the same. A sounding taken half a

mile off the cape gave 175 fathoms. I photographed the Cape, and we then steamed on towards Cape Mary Harmsworth. As we approached, a long, bare, low spit, beyond the ice-covered portion of the cape seen in 1895, opened up. It was off here we had such a bad time in July, 1895, when driven off the coast in our whale-boat, we hung between life and death for three days; expecting every moment to be our last. The sea is smooth now, with hardly a ripple upon it, and the sky a delicate blue, with scarcely a cloud. How different to the angry, black, storm-driven clouds, thick with snow, that rushed down upon us from the north then, and the ugly, dark, white-capped breakers, lashed into fury by the gale, that drenched us to the skin, and momentarily threatened to engulf us. The Arctic has an ever-changing face, and its smiling and angry moods are great contrasts.

This spit was doubtless covered deeply with snow this spring, and from the height from which we viewed it upon the high ice-clad land above, looked like sea ice. We now rounded the ice-covered portion of the Cape and went in towards the shore in deep water (fifty fathoms) to within half a mile of the low beach. A boat was lowered and we put off in a whale-boat with all the collecting apparatus necessary, together with guns and food. We then scattered in various directions in pursuit of objects of scientific or other interest.

Our attention was at once attracted by the large number of Ivory Gulls hovering about and seated on the ground, and soon to my great joy the conviction was forced upon me that this must be a nesting-place of this bird. The eggs are greatly prized owing to their rarity, and few have been collected. Admiral Sir Leopold McClintock was, I believe, the first to bring the eggs of this gull to England, and they are to be seen in the

museum in Dublin. Mr. Leigh Smith found these gulls nesting on low rocks upon May Island, but owing to the lateness of the season he only obtained young birds.

Owing to this now being the case most of the nests were empty, but after a diligent search I found ten eggs, and Dr. Koettlitz likewise secured two. Young birds in their greyish white, downy plumage, were running about in hundreds amongst the stones.

On approaching the nests, which we found scattered about in isolated patches or colonies over the greater portion of the spit, the parent birds became wildly excited, swooping down one after another with frantic screams within a foot or two of our heads, the whole colony joining in the attack. So daring were they that in one or two cases men were actually struck by them.

As we walked on we could see other colonies, each containing large numbers of nests, and as we left the one we had visited behind it gradually quieted down again, and as we approached the next colony the vehement cries and demonstrations were taken up by the birds there.

A number of young birds were taken on board the ship, which I hope to be able to deliver to the Zoological Society's Gardens, in London.* While engaged in collecting small marine life, in an inlet of the sea, for Mr. Bruce to preserve, I secured a jelly fish which, by-the-by, was not small, and stung my hands and arms considerably. Mr. Bruce came running up to tell me he had found an eider-duck's nest with two young ones and an almost hatched egg. So, taking my cameras, I went round and photographed it. The nest was on a stony flat near a fresh water pond, and consisted entirely of

* Seven survived to reach the Thames when six died, and the survivor I sent to Regent's Park where it now is.

down, but curiously fenced in with three old pieces of drift-wood. The old bird had flown off so I was unable

KIDER DUCK'S NEST ON CAPE MARY HARMSWORTH, WITH YOUNG AND EGG

to photograph her also according to the practice I have pursued of photographing both nests and parent birds when possible.

We took the ducklings on board to endeavour to rear and send them to the "Zoo."

As we walked over the low, stony, boulder-covered spit of broken up basalt, we could see that a large extent of snow-free country lay before us, probably containing two or three square miles. This was fairly level but con-

IVORY GULL'S NEST AND EGGS

sisted of tiers of raised terraces or old sea-beaches, of which Dr. Koettlitz tells me there are as many as twelve. Here and there are frequent shallow, thaw-water pools.

The vegetation is scanty in the extreme and is represented by a few lichens, mosses, a saxifrage, and a grass. Some very old whale-bones, apparently those of the *Balæna mysticetus*, lay scattered about at a height of about forty feet above the present sea-level, and a portion of a walrus head containing a tusk was found at the same height.

I devoted my time especially to collecting eggs of

the Ivory Gull and a few young birds as specimens, and in photographing the nest, eggs, and young, and in taking general views of the nesting ground. It occurred to me as being unusual that these gulls should here be found nesting upon the ground, whereas all previous records, I believe, refer to rocks as the spots chosen.

RECORD CAIRN ON THE SPIT OF CAPE MARY HARMSWORTH. AUGUST 7, 1897.

All nests, which are raised above the ground to an average height of six inches, had a base of from two feet to thirty inches in diameter, in those I measured. They consisted entirely of moss and a few white feathers ; and, in two cases contained two eggs, which are exceedingly like those of the kittiwake, but larger. There was a shallow depression at the top of each nest in which the eggs were deposited. In six cases only one egg was in the nest. These I believe to be addled, but they may contain large chicks, so I am keeping the eggs unblown to be operated upon by an expert on our reaching London.

I photographed three nests with eggs ; a collection

of birds and their nests, and a bird sitting on a nest of two eggs, which I also photographed after she had flown off. On our return to the rendezvous we had agreed upon, we put up a cairn with a Jack upon a seven foot bamboo staff, and in a bottle enclosed in a tin, placed amongst the upper stones of the cairn I left a record.

“THE JACKSON-HARMSWORTH POLAR EXPEDITION.

“This Expedition landed upon this cape—Cape Mary Harmsworth—on August 7th, 1897, having left Cape Flora on the previous day in the S.Y. *Windward*.

We intend to proceed north-west in the ship to ascertain if any land exists near this cape in that direction, and then, if possible, to reach the Johannesen Islands. All well on board.

“FREDERICK G. JACKSON,
“Commanding the Expedition.”

On a piece of paper enclosed in the tin I wrote the names of those who landed.

The Doctor found some small blocks of granite and some loose rock containing plant fossils and petrified wood.

Large quantities of drift wood (all old) and several pieces of birch bark were found scattered over the spit. A portion of the wreck of some vessel on the north side close to the water (possibly of the *Jeannette*), the vertebræ of a whale, several very old jaw-bones of apparently the *Balæna mysticetus*, and a very old upper jaw-bone of a bear. I saw a number of eider ducks, three or four looms in the water, two or three mollymokes, two kittiwakes, and one ringed seal. Captain Brown saw two narwhals off Cape Lofley. A number were also noticed in De Bruyne Sound.

Four species of jelly fish (two new ones) two worms, two species of shrimp (one new), buckie shells, mussels, and specimens of drift wood, and whale-bones were also obtained.

When three quarters of a mile off Cape Mary Harmsworth the lead gave 128 fathoms, and a little further west off the end of the spit, 150 fathoms. The greatest depth obtained in the Barents Sea to the south of Cape Flora was 80 fathoms.

After getting on board at 7.10 P.M. we steamed away north-west in the direction of the mysterious Gillis Land.

When we had proceeded north-west eight miles in water with a little, very light ice in it, a sounding gave 62 fathoms.

Course north-west, sixteen miles distant from Cape Mary Harmsworth, sounding 112 fathoms.

Course north-west, twenty-five miles distant from Cape Mary Harmsworth, 234 fathoms. Brown mud.

Course north-west, distant forty miles from Cape Mary Harmsworth, sounding 290 fathoms.

The drift, noted by the swab, was easterly.

August 8th, Sunday.—At 8 A.M. took observation for longitude by chronometer. It was then clear towards north and north-west, and so signs of land could be seen from the masthead, which I have incessantly visited. We had been steaming up a narrow bight in the ice running roughly north-west, with tight ice on either side.

Soon after 8 A.M. a thick mist came on, and about noon we came to tight ice ahead and lay-to for some time. As we cannot proceed further north-west, Captain Brown thinks it advisable to return on our course south-east. We have now steamed fifty miles north-

west from Cape Mary Harmsworth and no land is in sight, and there are no indications of it. A sounding at this point gives 230 fathoms and a bottom of brown mud.

This I think disposes of Gillis Land, and confirms my opinion derived from our observations made this spring from the top of the glaciated land above Cape Mary Harmsworth, that this land has no existence in the latitude and longitude laid down in the maps.

After proceeding south-east about eight miles the lead gave 223 fathoms. Bottom brown mud. After reaching our furthest limit north-west we went under sail when returning, but on my pointing out the importance of dredging here to Captain Brown, he unravelled the whips from his sails and together with some small quantity of 1 inch line he had on board made it up to 300 fathoms and let down the dredge. As it had a bag of sacking attached, it refused to sink properly in the 230 fathoms of water, so Brown then stopped the ship for four hours and lowered a swab instead. A large number of star-fish, a few sea-urchins and worms were the result. The mist still continued very dense. We then proceeded south-east under sail again.

Captain Brown is very unwell and is confined to his cabin.

Since writing the above I have frequently looked at the compass, and find the ship heading east of south, and on no single occasion west of south even by one degree, which is the assigned direction of the Johannesen Islands, in which direction I am informed the ice is too heavy to proceed, although I would like to sail over the supposed position of these islands. At midnight we were nevertheless out in the open sea without a lump of ice outside of us.

August 10th, Tuesday.—This morning I learnt that the same course had been steered through the night.

I would now like to make for King Charles Islands to the W.N.W. and get a look round from some high point upon them. We are at noon fifty-two miles from North-east Point—the nearest land on the King Charles Islands.

A longitude by chronometer by Armitage at 6 P.M. (the sun being on the prime vertical and a far better observation than this morning's) gives our position at noon: Latitude, $78^{\circ} 35'$ north; and longitude, $35^{\circ} 50'$ east, or about fourteen miles of latitude east of the position at noon given by this morning's longitude by chronometer observation. This makes our position at noon sixty-six miles from North-east Cape on the eastern extremity of the King Charles Islands, so I feel convinced that the Johannesen and Andreassen Islands, to the east of King Charles Islands, cannot be in the position assigned to them, or we should now see the former, as we are within a few miles of their supposed eastern coast.*

At 2 P.M. a sounding gave thirty-four fathoms, fine sand; at 6 P.M. forty-two fathoms, fine brownish sand, with black grains mixed.

By a meridian altitude I took at noon I find our latitude is $78^{\circ} 35'$ north.

August 11th, Wednesday. — Sounded at 1.35 A.M. Eighty-five fathoms; brown mud. At 11.30 A.M. took a sounding in 100 fathoms; brown mud and clay. Thick mist near the ice, with occasional showers of fine snow.

Some pomatorhine skuas were seen flying around

* Mr. Arnold Pike has since landed upon the King Charles Islands, and has confirmed my opinion that the Andreassen and Johannesen Islands have no existence in fact.

the ship. I went off in a small boat with Armitage and Wilton and succeeded in killing one. Later on I shot eight or ten more, including two specimens of the dark variety. I also shot one Arctic tern.

A few ringed-seals are to be seen in the water and numerous bear-tracks upon the ice-pieces, but no bear has actually been seen since leaving Cape Flora.

August 12th, Thursday.—Grouse day! My thoughts turn to the moors of Scotland and pleasant days with the gun there.

This morning we pushed for some hours through tight patches of ice with looser ice between, but whenever we tried west we met with tight ice. Captain Brown, who was on the bridge all night, finally turned the ship's head homeward, and we soon got entirely outside the floes. We could, however, have pushed in westward when we were further north had it been attempted.

I continued developing negatives.

At noon a sounding gave 65 fathoms; bottom brown mud; lat. $77^{\circ} 5' N$.

At 2 P.M. 64 fathoms; rock.

At 8 P.M. 58 fathoms; fine sand.

It has been overcast, somewhat damp, and a "Scotch mist" throughout the day.

At 10 P.M. the lead was lost from the sounding line. We kept outside the ice all day, steering a course for Hope Island. South up to 4 P.M., and then south-west and west.

August 14th, Saturday.—The *Windward*, under the best circumstances, will steam three and a half to four knots, only fifteen pounds of steam instead of twenty-five is now allowed since the breakdown off Hammerfest on the way to Franz Josef Land this summer.

At noon soundings gave 42 fathoms; fine sand and green mud.

Four P.M.—27 fathoms; small basaltic stones and broken shells. 6 P.M.—17 fathoms; small stones and broken shells. 8 P.M.—24 fathoms; small stones. 10 P.M.—34 fathoms; small stones and shells. Midnight.—64 fathoms; fine sand.

Various courses: tacking to a S.S.W. fresh breeze under steam and sail; frequently “breaking-off”; making for Bear Island. Sea rather rough.

August 15th, Sunday.—At 2 A.M.—42 fathoms; sand and shell. 4 A.M.—31 fathoms; sand and shell. 6 A.M.—23 fathoms; sand and shell. 8 A.M.—25 fathoms; gravel. 2 P.M.—32 fathoms; shells. 4 P.M.—29 fathoms; shells and small stones. 6 P.M.—28 fathoms; sand, shells, stones and coral. 8 P.M.—27 fathoms; coral, shells, and small stones. 10 P.M.—34 fathoms; coral, shells.

Strong south-west breeze. High sea. Overcast and generally misty. Tacking off Bear Island, which the thick weather prevents us from seeing.

August 16th, Monday.—This morning the weather cleared, showing Bear Island (south-east extreme, high and rocky) bearing west about twenty-three miles. The wind was westerly and unsteady. Captain Brown made a course for London, as he could not beat up against a head wind towards it.

Mount Misery (on north-east end of Bear Island) is marked on the charts as being 1200 feet high, and appears to be a rounded-off hill ending in a peak at the summit. The low land between it and the perpendicular rocks at the south-east extreme of the island gives the appearance at a distance of two small islands.

I tried my camera upon it. Printed from the

negatives recently taken, and toned and fixed a number of positives.

The air now feels delightfully balmy and warm. We are feeling the effect of the Gulf Stream. The barometer keeps about 50° F., which seems tropical to us.

August 23rd, Monday.—At about 10 A.M. the boiler again gave serious trouble. The wind had died away, and Captain Brown had begun to steam against the head sea. There was a pressure of only ten pounds of steam at the time.

August 25th, Wednesday.—This morning we sighted the coast of Norway in the neighbourhood of Breed Sund. About noon we passed several fishing-smacks, and obtained a few ling and cod from one, but they were only just out and had not caught many. We lowered a boat on steaming close up to another and tried to get more, but they were only just out from Bergen and were then setting their lines. We had had no fresh fish for more than three years. How we relish it!

The crew came back with some wonderful story about some English yachtsman having shot a pigeon from Andrée, with a note stating that he (Andrée) had crossed the 80° with a fair wind. He is on a most risky journey—the most so of any that has ever been attempted. He exhibits great pluck, and I wish him every success in his brave venture.

It is cheerful to see life and signs of a civilised world again. I noticed one black-headed gull this evening—the first I have observed. Hitherto I have seen only molly-mokes, puffins, kittiwakes, and an odd skua.

August 28th, Saturday.—This morning we passed through quite a fleet of fishing boats from Peterhead, and got a few herrings from one of them, which were thrown on board as there was too much sea to lower a

boat, and they were asked to report us at Peterhead. A head wind is still bothering us, chiefly from the S.S.W., and the sea is still high. We made short tacks in and off shore, and towards night took in sail and went under steam, as we had got to some extent under cover of the headland to the south of Aberdeen. We ran up the ship's number "T.H.P.Q." when off Buchanness.

We passed Aberdeen about 9 P.M., and kept on, under steam, about two miles from shore to take advantage of the tide running south for a longer time in-shore.

It is pleasant to see trees and green fields again, with all the evidences of life and the great world, after the lonely life we have spent for over three years in the dead, white land of the north.

September 1st, Wednesday.—Saint Partridge day!

Captain Brown had the crow's nest down early this morning. At 3 A.M. the wind headed us again. We passed Yarmouth about 7 A.M.

When between Lowestoft and Southwold we sighted pilot boat No. 5, and Captain Elvin, the pilot, came on board, and took the ship in hand.

The head-wind increased in force to a gale, and in the shallow water here, where no soundings show over 28 fathoms, it soon put up a sea, stopping our headway. After 2 P.M., when the tide set against us, we actually went astern, although under steam and fore-and-aft sails. Towards night the wind increased to a fresh gale, and we remained in much the same spot as we had been in the morning.

September 2nd, Thursday.—By midnight the wind had increased to a strong gale with the force of a whole gale in the squalls. The binnacle and side lights were frequently blown out, the main-top-gallant-staysail carried away and was torn to ribbons, and soon after, one

after another of the fore-and-aft sails followed suit, through the sheets parting. The result was that as the ship has insufficient engine power and was now carrying no sails, her head could not be brought up to the wind, and she lay quite out of control in the trough of the sea with the waves breaking over her.

The pilot frequently came down to look at the cabin compass, and about midnight, as the binnacle lights had again been blown out, was much concerned, remarking that things looked "very unpleasant, and that it would be mere good luck if we kept clear of other craft, as the ship was quite out of control, her steam power being entirely useless to stand against the gale."

The dogs were having a bad time on deck, and their melancholy howls would occasionally rise above the roar of the wind. "Gladys" and "Miss Råwing" were so frightened that they would not stay in their kennels, but left their pups and joined in the general chorus, as the roll of the ship or seas coming over, sent them splashing into the lee-scuppers. I went up and tried to help them, but came to the conclusion that they were better loose than tied up.

Below, things were flying about in all directions, and the gear in my cabin was in a hopeless mix-up, guns, boots, sponge, tooth brushes, soap, and water jug, mingled with my "go-ashore" clothes, being in a lovely muddle on the floor.

In the pantry a frequent crash of crockery indicated anything but a peaceful condition of things there. I lay part of the time on the couch in the little saloon, and by wedging myself in against the table rendered myself less movable, and tried to get to sleep, but a volley of charts from the rack above, followed almost immediately by an erratic bottle of whisky and a tin of

tobacco on the back of my head, which had taken legs on their own account, and which I had endeavoured to secure in a safe position, soon roused me up, and placed sleep quite out of the question.

Things went on in this manner throughout the night without improvement, and the pilot felt very uncomfortable owing to the uncontrollable condition of the vessel. He, however, amusingly took salve to his soul by saying he should charge for her as a sailing vessel, as she is only a steamer in name. The poor old *Windward*, I regret, got shockingly abused.

The gale still continued all morning. We are now abreast of Southwold, and with the flood tide can hold our own, but go to leeward directly it changes. Towards night the wind died down, the shallow sea here rapidly followed suit, and we began to forge ahead with a little speed ; the pilot tells me that to-morrow morning we shall be in the Thames if things go well.

CHAPTER XXXIV

HOME AGAIN!

September 3rd, 1897, Friday.—Here we are in the Thames again after more than three years absence and isolation from the world. How the thoughts return to that 12th of July when we stood upon the deck of the *Windward*, and said “good-bye” to friends and relatives (some of whom we then saw for the last time), who had come to wish God-speed to the little band of adventurers ere they drew aside the veil that separates the busy world from that land of mystery, that great unknown tract of the far north, where the foot of man had never trod, where the sun of knowledge had never shone. Are we quite forgotten by those who remain, are they satisfied with our achievements, and will they be at Greenhithe or Greenwich to welcome us? these are the thoughts which crowd through our brains as we crane our necks over the side of the vessel to make out the details of the well-known banks. Yes! there is Dr. William Neale, an Arctic man himself, whose genial face we all know so well, and my brother too, coming alongside, as we slowly weave our way through the river craft. How hearty are their congratulations and welcomes, and how we bombard them with questions as to the well-being of this person and that, and the events that have occurred during our years of absence. Some well-loved faces are not there, which would have been the first to welcome and grasp our hands had the relentless grip of death spared them!

A return Home after a long, and almost newsless absence is always tinged with sorrow, but certainly the many hearty welcomes and the kindness of our friends, do much to banish thoughts of sadness from our minds.

Soon we are ashore with our personal baggage, which the courteous Custom officials pass with as little trouble as possible consistent with their duty, and a short train journey lands us in the midst of London life once more. The Expedition is at an end!

How strange it feels to get into a frockcoat and under a tall hat and how uncomfortable a starched collar! The noise of the streets is quite nerve-jarring, and the weather which our friends laughingly assure us is but pleasantly warm, to us assumes tropical heat, as we wipe our perspiring foreheads and almost wish for a whiff of the chilly airs of Franz Josef Land to cool us.

Rapidly, however, these new sensations wear off, and we are hailing hansoms, dropping in-and-out of clubs, criticising *menus* like the most orthodox men-about-town, and by the discerning manner in which we decide upon the merits of this *entrée*, or that savoury, no one would imagine that the same men only a short time ago were swallowing with vast gusto large lumps of fat bacon, or junks of semi-cooked and leathery bear meat.

After our anxieties had been set at rest with regard to our friends, I fear our stomachs took precedence in our thoughts. How we enjoyed bottled beer and roast beef, two things we had always longed for in Franz Josef Land, and the satisfaction of coming face to face with the latter is amusingly illustrated by a telegram I received when seated at dinner on the night of our return, signed by my late comrades, who were dining together at a Piccadilly restaurant. It ran: "Isn't roast beef good!" followed by their names.

For three years we had been quite exempt from colds in the head owing to the fact that germs are unable to exist unless under exceptionally favourable circumstances in the Arctic. No sooner, however, did we return home than most of my late companions were immediately affected by it, and running noses and streaming eyes at once came in fashion.

Hundreds of telegrams of congratulation poured in upon me, as leader of the Expedition, from all parts of the world, but what I value most are the letters I received expressing approval of the work we have been able to accomplish, and of my conduct of the Expedition, from men whom I may be permitted to describe as the "Old Guard of the Arctic," who in times past have so gallantly upheld British prestige in the Polar area. Men who *know* the hardships and privations to be endured, the dangers to be passed through, and the difficulties to be surmounted; in a word *men who know the Arctic*. From such men as Admiral Sir Leopold McClintock, Admiral Sir George Nares, Sir Clements Markham, Admiral Sir Erasmus Ommanney, Admiral Albert Markham, Admiral Sir Vesey Hamilton, Captain Sir Allan Young, Mr. Leigh Smith, Dr. William Neale, and many others, I appreciate and value the honour of obtaining congratulation and approval, to obtain which is to me ample satisfaction for my labours.

I cannot close this attempted account of the Expedition without offering my warmest testimony to my fellow-workers and comrades in Franz Josef Land, to whose loyal support and assistance any success we may have attained is due. They worked hard and conscientiously to obtain the best results possible. They were ever busy, seldom was there idle time on anybody's hands, and I may say that their loyalty and industry have been

crowned with success. I have not attempted in this account to do more than touch upon the scientific work of the Expedition, which would more than fill the two covers in itself, but when this work is published, those interested will be able to judge of the amount of hard work expended by each and every member of the party. Work and constant occupation, combined with our doctor's good care of us, largely contributed to keep us in the good health we all enjoyed,* and made every one happy and contented, for I can say without the smallest hesitation that no happier or more contented little party ever existed in Northern latitudes. We were always busy, and to a great extent I believe that is the secret of our health and happiness, I say, to a great extent, for our doctor, Mr. Koettlitz, whose conscientious and thoughtful precautions to ensure our health must not be forgotten in connection with this matter. It is a true saying that prevention is better than cure, and if his medical office did prove somewhat of a sinecure, so far as human beings were concerned, he directed his energy to doctoring juvenile bears, baby walruses, dogs and ponies. The Arctic has proved very fatal in the past, and will in the future, unless every precaution is taken to ensure health and well being. His excellent geological work, together with his careful labelling of specimens—one of the most important points in collecting—has obtained the praise of higher authorities than myself upon this matter.

To the energy, and industry of Mr. Armitage is due the carefully recorded meteorological, astronomical, and magnetic observations extending over three years, and he, in common with all members of the party, lent

* None of us had a day's illness throughout the three years we were away.

every assistance to the advancement of each branch of science coming under our notice, for each man helped the other to the utmost of his ability. To Mr. Armitage's loyal aid I wish to offer testimony. We have been through rough times, and many dangers and hardships together, and I know the good material of

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which he is made. It is invidious, however, to particularise, for one and all did their best.

To Mr. Alfred Harmsworth I tender my hearty thanks for the all important part he played in contributing the necessary funds for fitting out and maintaining the Expedition, the total cost of which, owing to his objection, I am unable to state. I think it is due to him that I here contradict the suggestion, which I understand was made during my sojourn in Franz Josef Land, to the effect that the Expedition was organised by us for any other than purely scientific purposes, such statement being absolutely without any

foundation, and contrary to fact ; moreover, I desire to add, in connection with such statement, that I personally have received no pecuniary benefit whatever.

The plans of the Expedition are embodied in the following letter, which was written on the eve of my departure by Mr. Harmsworth to Mr. Arthur Montefiore, and published in the public press :

“ 12, CLARGES STREET, PICCADILLY.

“ MY DEAR MONTEFIORE,

“ To write ‘ a few words ’ on a subject one has at heart very deeply is not easy ; but I will be as brief as possible in my explanation of the reasons I had in mind when I decided on fitting out the present Polar Expedition.

“ From the time when, as a youngster, I read the story of Franklin I have always been fascinated by the great mystery of the North. Julius von Payer’s book and the concluding chapter of Admiral Markham’s “ Sir John Franklin ” decided me to contribute to the best of my ability to the exploration of Franz Josef Land, in itself a field for a vast amount of scientific work, and, in the opinion of many of the most distinguished Arctic men, the best road to the North Pole. Having, owing to the efforts of yourself, been made aware of Mr. Jackson’s wonderful energy and his recent work in the Arctic, I offered him the leadership of the Expedition, and secured an ally in whom I place the utmost confidence.

“ As to Mr. Jackson’s chances of reaching the Pole, I shall say nothing. For my own part, I shall be entirely satisfied if he and his companions add to our knowledge of the geography and the fauna and flora of Franz Josef Land and the area lying immediately north of it. With “ beating the record ” north I have very little sympathy. If Mr. Jackson plants the Union Flag nearer the Pole

than the Stars and Stripes (who head us by four miles only) I shall be glad, but if he came back, having found the Pole, but minus the work of the scientists, of which our expedition consists, I should regard the venture as a failure.

“I have emphasised this point particularly. Our venture is not a North Pole, but a Polar Expedition, a distinction with a vast difference. The advice and assistance given us by such authorities as the President of the Royal Geographical Society, the Council of the Meteorological Office, the Committee and Superintendent of the Kew Observatory, Captain Creak, R.N., of the Hydrographic Department of the Admiralty, Mr. B. Leigh Smith, Sir Leopold McClintock, Admiral Markham, Sir Allen Young, Mr. R. H. Scott, F.R.S., Mr. J. Coles, F.R.A.S., of the Royal Geographical Society, Mr. W. Harkness, F.C.S., of Somerset House, Sir George Thomas, Bart., and Dr. W. H. Neale, and the interest evoked throughout the world have been very gratifying to all the brave fellows who have elected to be left on Franz Josef Land for two—perhaps for four or five years.

“Yours faithfully,

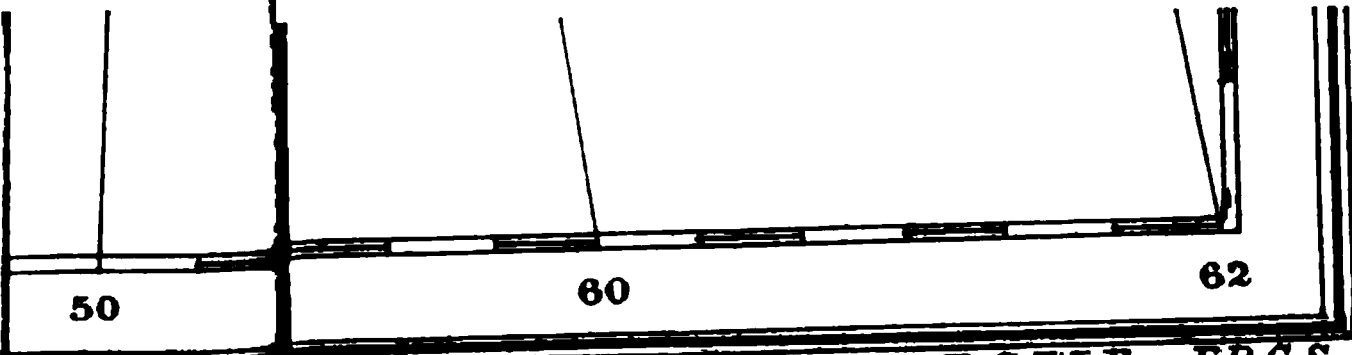
“ALFRED C. HARMSWORTH.”

I think I may say, without boasting, that the expectations and desires expressed in this letter have been fully realised.

My warmest thanks are also due for assistance and advice, to the President and Council of the Royal Society, the President and Council of the Royal Geographical Society, the Council of the Meteorological Office, the Committee and Superintendent of the Kew Observatory, the President and Council of the Geological Society, the President and Council of the Tyneside Geographical

Society, Captain Creak, R.N., Admiral Sir F. Leopold McClintock, Admiral Albert H. Markham, Mr. B. Leigh Smith, Dr. W. H. Neale, Admiral Sir Erasmus Ommanney, Mr. J. E. Harting, the late Dr. George Harley, Captain Sir Allen Young, Professor Vaughan Harley, Mr. D. Lewis-Poole, Mr. B. Daydon Jackson, Mr. R. H. Scott, Mr. Strachan, Sir Archibald Geikie, Messrs. E. T. Newton and J. J. H. Teall, Dr. Bowdler Sharpe, Mr. Eagle Clarke, Mr. F. W. Frohawk, Mr. Edgar Farman, Sir George Thomas, Bart., Mr. W. A. Bromwich, Mr. Frank Bromwich, Mr. W. Harkness, late of Somerset House; Dr. Chree and Mr. Baker, of Kew Observatory; Mr. G. E. T. Smithson, Mr. Arthur Jackson, Mr. Morris Colles, Mr. Alexander Nansen, Mr. Henry Cooke, and Mr. J. Jeaffreson.

Mr. A. Montefiore must also be remembered for his hard and enthusiastic work in assisting in the organisation of the Expedition.



*Published by
London & New*

F. S. Weller, F.R.G.S

CHAPTER XXXV

CONCERNING SCURVY.

ALL travellers in the Arctic are interested in the grave question of scurvy, which has played such havoc in the past, not only amongst Arctic expeditions, which perhaps have suffered most severely, but until recent years also in our merchant service and navy, in which even now cases happen. Credit has been given to the use of lime juice in these two services for the great reduction of scurvy on board ship—unfairly, it seems to me—for before we accept the theory that lime juice acts as a preventive of, or even as a curative agent in, scurvy, it would be well to ascertain in what way it acts upon the economy of the body, which question up to the present has remained unanswered; consequently its use can only be classified as empirical, and not founded on reason.

Before giving lime juice the credit of practically sweeping away scurvy from the mercantile and Royal navies, it should be remembered that other causes have been at work to promote health, such as improved sanitation, shorter voyages through the increase of steam power, and especially *better food*. For many years I have studied the question of scurvy, not only from records, but in countries where it is still rife, and the following are some suggestive facts I have collected. On the Nares' Expedition the crews of both the *Alert* and *Discovery* suffered greatly from this malady, although lime juice was daily taken by all hands when on board. A

little only was taken when sledging, in accordance with the practice then adopted on all such journeys. Yet, I hardly think, the warmest advocate of lime juice nowadays would go so far as to say that the outbreak of scurvy, when sledging for a few weeks, was caused alone by its omission. Thus we have an instance of lime juice taken daily, with the exception of a few weeks when sledging, and scurvy is rife amongst the crews of both ships. On the other hand, Mr. Leigh Smith's party, with its medical officer, Dr. W. H. Neale, after the loss of the *Eira*, spent nine months, including a winter, upon Franz Josef Land under very rough circumstances, and *without* lime juice. They, however, lived upon newly killed fresh meat, and no case of scurvy occurred amongst them. When living amongst the Samoyads upon Waigatz and the Bolshaia Zemelskija Tundra of North-East Russia, some striking facts came under my notice indicating the cause of scurvy.

Amongst the Samoyads, who yearly winter upon Waigatz, and never take vegetables or even know what lime juice is, scurvy is unknown. They, however, live upon fresh reindeer meat.

On the other hand, scurvy is common amongst those Samoyads who go south to the Petchora River with the Russian peasant traders in the autumn, and live in common with them in the districts adjoining the large rivers upon salted fish until the following May. This salted fish I can testify from personal experience is invariably very imperfectly cured. In fact, both the Samoyads and peasants prefer it "high." Scurvy is also common amongst the peasants who live upon this food. When at Kharbarova, a Samoyad village on the Yugor Straits, in 1893, a striking case came under my notice indicative of the cause of scurvy. Six Russian priests, whose

religion forbids them to eat meat but allows salted fish, were left at the village in a hut put up for their use by Siberiakoff, the Siberian millionaire, to spend the winter, a year or so before I arrived there. A little Russian boy, whom I have seen and conversed with, was left to wait upon them. The six priests lived almost exclusively upon tea, bread, and salt fish. The boy had similar food excepting that, instead of salt fish, he ate fresh reindeer meat. None of them had any vegetables.

In the following spring, when the Russian traders returned, they found that all the six priests had died of scurvy; whereas the little boy, who had lived on fresh meat and had not partaken of the fish, was alive and quite well, and had buried all his late masters in the snow. He was the only living being in Khabarova when the Samoyads and Russians returned. The graves of the six priests I have myself seen. These facts were related to me by reliable witnesses when at Kharbarova. They indicate, I think, that the trouble lay in the imperfectly cured fish.

From these and the following facts I have come to the conclusion that the use of lime juice neither prevents nor cures scurvy; I entirely agree with the views of Professor Torup, and believe that scurvy is a disease developed through eating tainted food—that, in fact, it is a slow poisoning of the system through the absorption of the products of decomposition, known to chemists as “ptomaines.”

Looking now at our own experiences during our stay in Franz Josef Land in the light of these theories, we have on one hand the crew of the *Windward* of 1894 to 1895, which wintered there, taking their ounce of lime juice with the greatest regularity daily, and yet scurvy broke out, causing at least one death directly attributable

to it, and numerous other cases occurred on board. Lime juice also gave no beneficial results when administered to the sick men. There was a supply of fresh potatoes on board, in addition to a quantity of desiccated vegetables. On the other hand, my own party ashore practically took no lime juice, as only two or three drank it as a refreshing drink for the first few months, after which none was used. I personally did not take it at all. None of us had a symptom of scurvy, although we lived there for three years. We used only desiccated vegetables, which are supposed, according to Dr. C. H. Fagge, to have no anti-scorbutic value, some tinned tomatoes, and during the second winter a little frozen scurvy grass. In the case of the crew of the *Windward*, I fear that there was considerable carelessness in the use of tinned meats that were not free from taint, although tins quite "gone" were rejected; and even some of the sick men contrived to obtain the salted meat,* which I had locked up, with orders that it should not be served out, when the first case of scurvy occurred, as I have always suspected it of being the great cause of scurvy in the past, as, in my opinion, it always contains ptomaines, for it is never perfectly cured.

With regard to my own party, which was under my immediate supervision, either Dr. Koettlitz or I *always* saw that all tinned or other meat used was perfectly good and wholesome before any one partook of it, and I would not allow a single tin to be eaten until it had passed our censorship. We largely used fresh bear's meat, and the crew of the *Windward* were also allowed as much as they could be induced to eat. They, however, preferred tinned meat several days a week to a

* This I did not hear of until months after the ship had left Franz Josef Land.

diet of bear's meat alone; and some of the crew had such a prejudice against bear's meat as to refuse to eat it at all.

Confirming these views and the experiments made on monkeys presently related, Dr. George M. Robertson, of the Perth District Asylum, relates to me the case of a woman who had been sent there as a patient, chiefly owing to her affliction taking the form of eating all manner of filth from pigs' troughs, which would contain ptomaines. This woman arrived at the asylum suffering from spongy, ulcerated gums and other indications of incipient scurvy—in fact, from what is sometimes called “land scurvy”—and ultimately all her teeth, except the canines, fell out. Professor Vaughan Harley, in his pamphlet upon sugar as a food, mentions the case of a ship leaving the West Indies, and soon after the voyage began scurvy broke out. In course of time their provisions failed them, and they were forced to make use of their cargo of sugar to live upon, with the result that the scurvy ceased. It appears to me probably what happened was this. In all likelihood their provisions largely consisted of imperfectly cured meat, which, on being finished, the ptomaine poison contained in it was finished also, and the scurvy died a natural death, allowing the men to recover. The sugar, in itself a wholesome and good food, merely kept the men alive by its nourishing qualities, but had no specific curative effect upon the scurvy.

Prevention is better than cure in the case of scurvy, as in all other evils to which man is heir. The prevention in this case I believe to be the use of fresh, or at all events untainted, food, or, in other words, food free from the poison of ptomaines. But once contracted, the fundamental principle to be kept in view is the prevention of

the continuance of this poisoning process, which, if continued, must end fatally, by the substitution of any kind of fresh food, not necessarily vegetables.

On returning to England in September, 1897, in the course of conversation I communicated my ideas as to the cause of scurvy to my friend Professor Vaughan Harley, and at his suggestion I called upon Lord Lister and Professor M. Foster, and explained my views to them, applying through them to the Royal Society for a grant to enable me to carry on experiments upon living animals by feeding them with tainted tinned meat, Professor Harley promising to conduct the experiments at his laboratory at University College.

The Royal Society has honoured me by giving me this grant, and the experiments have been begun, with what results I will now leave to Professor Vaughan Harley, my colleague in this matter, to relate.

AN EXPERIMENTAL INQUIRY INTO SCURVY.

By VAUGHAN HARLEY, M.D.

Professor of Pathological Chemistry, University College, London.

THE cause of scurvy was until recently considered to be the want of fresh vegetables, but Mr. Frederick Jackson collected facts both from his own personal experience and the result of investigating the records in connection with scurvy, which led him to agree with the opinions of Professor Torup. Professor Torup considered it due to eating meat which had not been properly preserved—in fact, scurvy to be a ptomaine-poisoning. If meat is not properly preserved micro-organisms contaminate it, and as a consequence it goes *bad*—the bacteria chemically change the albumen, fat, and carbohydrates in the meat,

A SKI PARTY IN SUMMER

and the new chemical products formed (ptomaines) cause the change in colour, smell, and other alterations which we designate as putrid meat. As a matter of fact, science has shown that preserving food really is to keep it free from micro-organisms, and so long as this is properly done the food will not go bad. At the same time, before the meat has actually gone so bad as to be repugnant to the sense of smell and sight, bacteria may have done their work, and yielded their ptomaines. Such meat is best called *tainted* for the purpose of description. It is such *tainted* meat, and not bad meat, that one must look to as the cause of scurvy. In fact, the greater prevalence of scurvy in the winter than the summer—which used to be argued in favour of the fresh vegetable theory of the disease—is in support of this ptomaine theory ; for in summer, if meat is kept, the bacteria would proliferate with such rapidity that the meat would soon smell bad and be rejected. In winter it would not taint so rapidly, and might be cooked and eaten without thought of danger. It must be remembered that, although cooking will destroy bacteria, the ordinary heat so used would have no action on their chemical products, or ptomaines. Again, if the meat were putrid, eating it would cause acute ptomaine-poisoning, with headache, violent diarrhœa, sickness, &c., within a few hours ; while if only slightly tainted meat were taken, the dose of the ptomaine with each meal would be so small as to cause no immediate symptoms, and the disease would gradually develop itself as we know scurvy does. In conversing with Mr. Jackson on this subject, I suggested that before we accept the “ptomaine theory” of scurvy, it would be well to see if it was possible, experimentally, to reproduce the symptoms of scurvy, or anything like it, by feeding animals with ptomaines ; and for this purpose I suggested

he should apply to the Royal Society for a grant towards the expenses of such a research. Mr. Jackson laid his facts before Lord Lister and Professor Michael Foster, and as a result received the required grant, and I undertook to conduct the experiments in my laboratory at University College, London.

Our method of experimenting and the results so far obtained can be briefly summarised.

Monkeys were employed, as they were the nearest approach to man that could be used in such a research. The animals were fed on a diet of boiled rice and dry maize, and, as far as warmth, light, and air, all were treated the same. Unfortunately the monkeys used had to be freshly imported ones, and hence in the process of acclimatisation some died from diarrhœa. Rice is considered to have no anti-scorbutic properties, and the same may be said for maize, so that the staple diet contained nothing equal to the fresh vegetable diet ordinarily employed. Finding they took this diet well, the rice was boiled daily with meat, and to one series of monkeys good meat was used, while to another series the meat had previously stood in the laboratory exposed for some two or more days until it was slightly tainted, although it had no bad smell. We thus had two sets of monkeys under the same conditions, but one series, in addition to their rice and maize, had good meat, and the other tainted meat. They were then watched from day to day and their weight taken. It was found in the case of the monkeys fed with tainted meat, that in from nine days to a month they began to show symptoms—*i.e.*, as a rule, diarrhœa tinged with blood was first noted, and soon after the gums were found spongy, easily bleeding when touched, and with this there were marked wasting and general feebleness, but no tenderness of the limbs and no dis-

coloration of the skin as found to occur in man affected with scurvy. In the case of the monkeys fed on the good meat, although they had in some cases diarrhœa and there was loss of flesh, in no case, even after the diet had been continued, were there any spongy gums, and only once blood in the motions. That these monkeys should lose

HIS FIRST AND LAST RIDE

some weight is not to be wondered at, considering that the diet used can hardly be considered the best for freshly imported monkeys that had not been sufficiently long in England to stand the climate well. These experiments are naturally only in a preliminary stage, but the results so far obtained show that by feeding with tainted meat one obtains a condition much resembling scurvy, if not scurvy itself. At the same time the experiments do not quite negative the fresh vegetable theory as being one of the preventions. No scientific investigation on the subject of scurvy has been prosecuted since the dis-

coveries of Pasteur have shown us the havoc produced by bacteria as a cause of disease. Therefore, with this new scientific light to guide us even in such a difficult problem as scurvy, there is every probability of a successful issue. At the same time we must remember that the disease described as scurvy in the various circumstances in which it has been met in the past does not seem to be one pathological entity. The research will be continued in order to try and investigate the fresh vegetable theory of prevention, as it is of the utmost value to mankind that such a question should be settled.

APPENDIX

NOTES AND DESCRIPTIONS OF THE EGGS COLLECTED
BY FREDERICK G. JACKSON AND THE JACKSON-
HARMSWORTH POLAR EXPEDITION IN FRANZ JOSEF
LAND, 1894 TO 1897. BY F. W. FROHAWK, M.B.O.U.,
F.E.S.

SNOW BUNTING (*Plectrophenax nivalis*).—A nest and five eggs (originally six) found at Cape Flora June 22nd, 1895 ; a compactly constructed nest, composed externally of various grasses, fibres, and roots, lined with wool and hair of Polar bear and an abundance of feathers ; all, with the exception of two or three, are white. Four of the eggs average $1\frac{1}{2}$ in. long and $\frac{2}{3}$ in. in breadth, the fifth egg being very small, measuring barely $\frac{3}{4}$ in. by $\frac{9}{16}$ in. They have the ground colour white, with the slightest tinge of greenish-blue, and are blotched and speckled with rust-brown and purple-grey ; two are scrolled with dark brown.

Another nest with six eggs, found on Gully Rocks June 23rd, 1895. A compact, neatly constructed nest, similar to the one described, but without the quantity of wool and a much smaller quantity of feathers, which are principally interwoven. The six eggs (full complement) of quite a different type, the ground colour being greyer and without any rust-brown markings, being blotched and speckled with pale lilac, and spotted and scrolled with purple-black.

One odd egg also found on Gully Rocks ; similar form as the first clutch mentioned. Mr. Jackson tells me : "Nests and eggs were plentiful upon the southern islands of the group, and I photographed a nest and eggs in a cleft rock upon Cape Flora."

EIDER DUCK (*Somateria molissima*).—Of this species Mr. Jackson gives me the following note, which is of interest, as the eider duck is supposed to be an especially abundant species on Franz Josef Land.

“A nest containing one egg on the point of hatching and two chicks was found upon the low spit of Cape Mary Harmsworth. The nest consisted entirely of down, with three pieces of old driftwood laid as a kind of fence around the nest. This was the only case of a nest being seen by us. I photographed the egg, chicks, and nest.”

The egg referred to I received with the ivory gulls', it being a normal egg in size and of the greyish-green form.

PURPLE SANDPIPER (*Tringa striata*).—Four eggs. A very handsome clutch, varying from $1\frac{7}{8}$ in. to $1\frac{5}{8}$ in. long by $\frac{1}{4}$ in. in breadth. The ground colour is pale green, boldly blotched and mottled with rich reddish-brown of different depths, and underlying markings of purplish-grey. The markings run in an oblique direction similar to the markings on the eggs of the common snipe, and excepting for their smaller size it would be impossible to distinguish them from certain varieties of the eggs of that species.

“The nest was found by Mr. H. Fisher upon a swampy bank, about thirty feet above the sea, on the eastern side of Cape Flora, on June 25th.

“The nest was a mere hollow in the ground, and contained the four eggs.

“The hen bird showed great anxiety on his approaching the nest, and by a variety of antics endeavoured to attract him away from it, much in the same manner as the lapwing does. Mr. Jackson adds that “the nests of this bird are exceedingly difficult to find, as this was the only one discovered, although many hours were spent at various times in searching for them. The birds were fairly common upon all the capes visited on the southern coast of Franz Josef Land, Cape Mary Harmsworth excepted.”

As the purple sandpiper breeds as far south as the Faroe Islands, there is considerable interest attached to the breeding range of this bird; and there is every probability that it may

eventually be discovered to be actually a British-breeding species.

GLAUCOUS GULL (*Larus glaucus*).—A clutch of two eggs, measuring $2\frac{3}{4}$ in. by $2\frac{1}{8}$ in. and $2\frac{7}{8}$ in. by 2 in. respectively. The ground colour is pale olive-buff, or stone colour, spotted with different shades of brown, purplish-grey, and ash-grey. The nest was found by Mr. Jackson upon a precipitous grassy mound (formed of broken débris from the cliffs above and guano from the guillemots) above the lower tier of rocks overhanging the talus of Cape Flora at an altitude of about six hundred feet above the sea. Mr. Jackson gives me the following interesting particulars: "The nest consisted of a mass of dried grass, feathers, and moss, and was of considerable dimensions. It contained two eggs. One of the birds, on my approaching the nest, scattered some of the materials of the nest over the eggs, with intent to conceal them undoubtedly. The old birds showed considerable courage in defending the nest, swooping down within a foot or two of my head, and uttering loud screeches as they passed. Two or three more couples were seen nesting in more or less inaccessible places upon most of the capes along the southern coast."

KITTIWAKE GULL (*Rissa tridactyla*).—Twenty-six eggs collected at Cape Flora by Mr. Child from June 21st to June 30th, 1895. A nice variable series, both in size and colouring; measuring in length from $2\frac{1}{3}$ in. to $2\frac{1}{2}$ in. and in breadth $1\frac{1}{8}$ in. to $1\frac{1}{2}$ in. The ground colour varies from pale greenish-blue to dull olive-buff. The smallest specimen is only faintly spotted with ashy-grey, evenly distributed over the surface. In this egg the usual brown markings are indicated only by a few minute specks hardly visible. One egg is very handsomely blotched with very large confluent brown blotches, and the usual underlying grey markings on a pale buff ground; another has the ground colour pale greenish-blue, profusely sprinkled over the large end with small deep purple-brown and ash-grey dots. Over the rest of the surface they are sparsely and evenly distributed.

Mr. Jackson found these birds nesting in colonies upon most of the southern capes, generally on the rocks of the cliffs below those chosen by the guillemots; "but occasionally the colonies of kittiwakes were sandwiched in amongst the looms [guillemots]."

The nests were of considerable bulk, and constructed of dried grass, moss, and feathers, with a shallow depression for the eggs."

Several hundreds of kittiwakes' eggs were obtained by Messrs. Jackson and Blomkvist at Cape Flora, which were utilised as food.

IVORY GULL (*Págophila eburnea*).—Eggs of the ivory gull are extremely rare in collections. In 1885, when the third volume of Seebohm's "British Birds" was published, only four authentic eggs were known to exist. Of these he says: "The egg obtained by M'Clintock is in the museum of the Royal Dublin Society; two eggs obtained by Malmgreen are in the Stockholm Museum; and a third [fourth] is in the collection of Mr. Benzon in Copenhagen." But in the *Ibis* for 1888 Professor Collett published a description of others, together with a plate of two eggs and a young bird in the down. Therefore it was with no small amount of pleasure for me when I received for preservation last autumn the twelve ivory gulls' eggs collected by Mr. Jackson in Franz Josef Land.

As they were then unblown, the colours were in some considerably brighter than they are now. This is particularly noticeable in those having the ground colour of a light greenish hue. I figured three of the eggs directly after being blown, and one, which then had a distinctly green hue, shows now only the faintest indication of green in the ground colour. The following is a table of measurements of the twelve specimens, which may be of interest to ornithologists generally.

				LENGTH.	BREADTH.			
Egg No.	1	.	.	.	$2\frac{3}{10}$ inches	by	$1\frac{4}{5}$ inches	
"	2	.	.	.	$2\frac{5}{12}$	"	"	$1\frac{4}{5}$ "
"	3	.	.	.	$2\frac{1}{3}$	"	"	$1\frac{4}{5}$ "
"	4	.	.	.	$2\frac{9}{10}$	"	"	$1\frac{4}{5}$ "
"	5	.	.	.	$2\frac{2}{5}$	"	"	$1\frac{4}{5}$ "
"	6	.	.	.	$2\frac{1}{2}$	"	"	$1\frac{2}{3}$ "
"	7	.	.	.	$2\frac{2}{5}$	"	"	$1\frac{2}{3}$ "
"	8	.	.	.	$2\frac{2}{5}$	"	"	$1\frac{2}{3}$ "
"	9	.	.	.	$2\frac{2}{5}$	"	"	$1\frac{7}{10}$ "
"	10	.	.	.	$2\frac{1}{3}$	"	"	$1\frac{7}{10}$ "
"	11	.	.	.	$2\frac{3}{10}$	"	"	$1\frac{7}{10}$ "
"	12	.	.	.	$2\frac{1}{5}$	"	"	$1\frac{2}{3}$ "

} broadest

} longest

1 2 3 *314.1701.1.1.1*

FIG. 1.—Ground colour pale greenish-ochreous, the darker markings varying from dark-purple-brown to palish umber-brown; the paler markings represent the underlying blotches of different shades of grey.
 FIG. 2.—Ground colour rather deep olive-buff, boldly marked with rust-brown and leaden-grey.
 FIG. 3.—Ground colour light buff; the markings vary much in colour from dark-brown to light ochreous and various shades of grey, from deep purple-grey to pale ashy-blue. Some of the blotches are composed of minute spots collected together, and, as will be seen by the figure, the specimen is somewhat finely scolloped with dark lines.

IVORY GULL'S EGGS

In six eggs the ground colour is olive-buff, but varying slightly in depth ; in three it is pale greenish-buff ; one dull buffish-olive, one ochreous-olive, and one greenish-ochreous-olive. They are blotched and spotted (varying from large blotches to minute specks) with different hues of brown, from dark purple-brown to light yellow-brown ; and underlying markings of varying shades of grey, from purplish-grey to light bluish-ash. One specimen is considerably streaked and scrolled with the different hues of brown ; and one is but slightly spotted with brown, but has the large end almost completely covered with large confluent ash-grey blotches, which almost obliterate the pale ochreous-buff ground colour. They very closely resemble kittiwakes' eggs in colour, much more so than they do common gulls', but are similar to the latter in size.

The twelve eggs were obtained at Cape Mary Harmsworth on August 7th, 1897. Ten of them were collected by Mr. Jackson, and two by Dr. Koettlitz.

From the following most interesting account by Mr. Jackson of the nesting of the ivory gull, it is evident that this gull usually lays two eggs, as the single eggs found were addled, the companion egg having been hatched.

Mr. Jackson writes : " Upon our landing upon the low spit of fairly level ground, upon which as many as twelve raised beaches can be made out, and are covered with rugged basaltic stones and boulders, we noticed great numbers of ivory gulls hovering around and seated on the ground. We soon became aware that they were nesting upon the ground of this barren spot, the only vegetation of which consisted of a few lichens, mosses, a saxifrage, and a grass growing in the scanty soil. Here and there are a few ponds of thaw-water and swampy spots.

" We approached the nests, which consisted of a pile of moss raised about six inches above the ground, with a base of from two feet to thirty inches in those I measured, with a slight depression at the top, in which the eggs are deposited. Here and there in the nests were a few white feathers. Owing to the late date most of the nests were without eggs, but in six cases I found six single eggs and in two nests two, all of which I believe to have been addled, which accounted for their being there. I, however,

brought them home to be blown by an expert, fearing that they might contain large chicks. This Mr. Frohawk kindly undertook to do. Dr. Koettlitz also collected two, which he handed to me. Running about amongst the dark stones were large numbers of young gulls in their downy plumage of greyish-white, and a few dead ones lay here and there.

"These birds were found building in isolated colonies over the greater part of the spit, which probably contains two or three square miles of country bare of snow. As we approached them the birds became wildly excited, dashing down within a foot or so of our heads with wild screeches and screams. So bold were they that in more than one case members of the party were actually struck by them.

"I took several photographs of the nests containing eggs and young; also of a gull sitting upon a nest, and one negative of a general view of the nesting-ground.

"They were nesting on this spot literally in hundreds. We took a number of young birds on board the ship, seven of which lived to reach the Thames, where six died, leaving only one, which I was able to send to the Zoological Gardens, where it now is."

RICHARDSON'S SKUA (*Stercorarius crepidatus*).—I believe this to be the first recorded instance of this skua breeding so far north as Franz Josef Land, as this species is generally considered less Arctic in its habits than the other skuas. Mr. Jackson informs me that Richardson's skua is the only skua seen on Franz Josef Land, and that he has photographs of the adult birds, their nests and eggs, taken at Cape Flora. The nine eggs in the collection were obtained from July 6th to July 22nd from Cape Gertrude, Cape Grant, Cape Crowther, and Bell Island. They all agree exactly in all particulars with normal eggs of *S. crepidatus*. They measure in length from $2\frac{3}{8}$ in. to $2\frac{7}{8}$ in. and $1\frac{5}{8}$ in. to $1\frac{3}{4}$ in. in breadth. In the ground colour they vary from pale green-buff to light olive-brown, and are blotched, speckled, and scrolled with different shades of brown and underlying markings of brownish-grey. In three the markings are confined to a zone round the large end, the others having the markings more or less evenly distributed over the surface.

BRÜNNICH'S GUILLEMOT (*Uria bruennichi*).—A series of thirty-six eggs, mostly collected on June 30th, 1895, at Cape Flora. Three are labelled "Cape Grant, August 5th, 1895."

These eggs are so similar to those of the common guillemot (*U. troile*) that it would be practically impossible to distinguish them. But certain characters of the former species I will presently allude to.

I may here mention that the most northern breeding range of the common guillemot is Bear Island, in latitude 74° , which is comparatively mild, being influenced by the Gulf Stream; otherwise the northern range of this bird is below latitude 64° . Above this latitude its place is taken by *U. bruennichi*.

In shape the eggs of *U. bruennichi* are, on the average, decidedly less pyriform, shorter and rounder, some being decidedly so; while some are as elongated and attenuated as *U. troile*. They are also, as a rule, greener in ground colour, and have less variation in the colouring generally. Thirty-one out of the thirty-six have the ground colour more or less green, the majority being decidedly green, and have less of the blue tinge that is so frequent in the eggs of *U. troile*. Four only have the ground colour white, and but one with a creamy-white ground; and the only specimen which varies greatly from the rest is finely scrolled with cotton-like lines of ochreous-brown and purple-grey, which are densely massed together over the large end; and others are rather thickly and evenly scattered over the rest of the surface. Another specimen is nicely blotched with lilac-grey and black, and three others have pale brown markings. In all the rest the markings are either black or brownish-black. Another character of some distinction, but by no means constant, is that in some specimens the markings have pale centres forming irregular rings, which is seldom the case in eggs of *U. troile*; but I have specimens of the latter from Orkney exhibiting precisely similar markings; therefore this cannot be a certain distinguishing character. In by far the greater number of these *U. bruennichi* eggs the markings are solid, and in no way differing from those of *U. troile*.

BLACK GUILLEMOT (*Uria grylle*).—Four normal eggs collected from June 23rd to July 3rd, 1895, at Cape Flora and Gully

Rocks. They measure in length from $2\frac{1}{4}$ in. to $2\frac{3}{8}$ in. and $1\frac{2}{3}$ in. to $1\frac{1}{2}$ in. in width.

LITTLE AUK (*Mergulus alle*).—Five eggs, varying in length from $2\frac{1}{12}$ in. to $1\frac{5}{16}$ in. and in breadth $1\frac{9}{16}$ in. to $1\frac{1}{3}$ in. The colour is of the palest greenish-blue, very faintly spotted and streaked with ochreous. One specimen shows the faintest lilac-grey blotches. Two are from Cape Grant, July 3rd, 1895; and one from Cape Flora, July 16th, 1895.

NOTES ON THE BIRDS OF FRANZ JOSEPH LAND SEEN
BY THE JACKSON - HARMSWORTH POLAR EXPE-
DITION 1894 TO 1897. BY FREDERICK GEORGE
JACKSON.

AN excellent article on the avifauna of Franz Josef Land by Mr. W. Eagle Clarke has appeared in the *Ibis* for the present year (pp. 249 to 277). This memoir is especially valuable, as Mr. Clarke has collected together under one heading all the references to the birds observed by previous visitors to the Archipelago, including Herr J. von Payer, Mr. Leigh Smith, Dr. Neale, Dr. Nansen and Colonel Feilden. In Mr. Clarke's paper are given some observations by Mr. W. S. Bruce, who accepted the hospitality of my expedition during the last year of our stay in Franz Josef Land. The specimens prepared by Dr. Koettlitz were sent to the British Museum for examination, and it is a matter for regret that those which Mr. Bruce had in his possession were not despatched there by him also, so that the collection could have been treated as a whole, or on the other hand, Mr. Harmsworth and myself would gladly have consented to the remainder of the specimens being submitted to Mr. Eagle Clarke, who it must be confessed has done his description of the portion of the collection intrusted to him in his usual admirable and complete manner. To Dr. Bowdler Sharpe I am greatly indebted for the examination of the specimens sent to the British Museum, and much help in their determination.

SNOW BUNTING (*Plectrophenax nivalis*).—A few of these birds still remained on Cape Flora on our arrival in the *Windward* in September 1894. I shot a young bird on the talus there on September 23rd, and others did not leave for the south until a few days' later. The winter began early and severely that year. Snow buntings reappeared in the spring of 1895 and 1896 upon April 27th of each

year. None were seen after October 6th, 1895, when I noticed one young bird, and I saw three on October 2nd, 1896, but none after. They were reported to have appeared on Cape Flora in 1897 on the 16th of April when we were away sledging.

Dr. Nansen records snow buntings from Torup Island (latitude $81^{\circ} 30'$), in August 1895. This bird was noticed by us upon all the capes on the southern coast of Franz Josef Land, from near Cape Cecil Harmsworth to Cape Neale, and upon several spots on the eastern side of the British Channel.

Several nests were taken upon Cape Flora, where it breeds in considerable numbers upon the raised beaches amongst the stones, from a few feet above sea level to a height of 80 ft., and I saw two nests upon the talus below the rocks at a height of 200 ft.

One nest which I found in the deep cleft of a rock upon the plateau I photographed on July 20th, 1896, and also another built on a ledge of a huge basaltic boulder called Sharpe's Rock, where there was a nest in the same spot three years in succession.

We could have taken large numbers of eggs had we not protected these birds. They had paired on Cape Flora by the first week of June. Most of the eggs hatched out towards the middle of July. The young birds remained later in the autumn than the adults.

LAPLAND BUNTING (*Calcarius lapponicus*).—I shot two of these birds on June 10th, and one on June 11th, 1896, all being cocks. One was killed on June 9th, 1897, by Mr. Armitage. Mr. Eagle Clarke thinks that they were probably stragglers from Novaya Zemlia, where the species is uncommon during the nesting season. It has not been recorded from Spitsbergen.

With his opinion I am inclined to agree, as at no other period of our stay in Franz Josef Land were other examples of this bird seen, and I believe we bagged all that reached Cape Flora.

Still its appearance two years in succession presents a reason for leaving this an open question, in which possibly Mr. Clarke would have coincided had he known of its second appearance. As he remarks, this was an unlooked-for addition to the fauna of this Archipelago.

SHORE-LARK (*Otocorys alpestris*).—A single specimen was obtained, on the 9th of June, 1897, upon Cape Flora. It is probably only a straggler to Franz Josef Land, as it is unknown in Spitsbergen. It is, however, not an uncommon visitor in Novaya Zemlia in summer.

N.B.—A species of Redpoll (*Cannabina holboelli?*) has been spoken of by Dr. Neale, but no specimen was obtained, and it was probably the Snow Bunting which was intended.

COMMON SWALLOW (*Hirundo rustica*).—On May 27th, 1896, I find the following entry in my journal.

"About 9 P.M. this evening Heyward came into the hut to tell me that a strange bird was flying near. I took my gun and followed by Blomkvist, went out and fired at what appeared to be a small black and white bird, having a forked tail and generally resembling the common swallow. Blomkvist at once remarked upon the similarity.

I unfortunately only wounded it as it flew by, and it either fell or settled amongst the boulders near the flagstaff. Hours of search failed to discover it, as the snow was falling heavily at the time, rendering it more difficult to see a small object."

The Common Swallow has been found in Iceland, Spitsbergen and Novaya Zemlia, so there is nothing very remarkable about its appearance in Franz Josef Land. It is, however, undoubtedly only a casual visitor here.

SNOWY OWL (*Nyctea nyctea*).—During the first twelve months we were in Franz Josef Land we saw no examples of this bird, although the pellets and feathers frequently seen upon all the capes from Cape Flora to Cape Neale convinced me that the bird had been there.*

Dr. Koettlitz reported to me that an Owl had been seen on May 28th, 1896, which was the first noticed that spring. On June 30th, 1896, Mr. Armitage shot one specimen with a rifle, and on August 26th, Mr. Wilton captured a sick one alive. They were very wild and difficult to approach.

Dr. Neale states that he saw the first Snowy Owl on Cape

* On September 6th, 1895, I saw a bird late in the evening seize a young loom coming down from the rocks of Cape Flora which I believe to have been a snowy owl.

Flora on the 8th of February, and others were noticed on the 16th and 19th of the same month.

All had left us by the end of the first week of September.

On May 30th, 1897, I saw the first Snowy Owl of the season, which had killed a Kittiwake and was feeding upon it. Mr. Heyward told me he believed he saw one on the previous day.

The species was frequently seen on and near Cape Flora after this date, but no nest was ever discovered, although it is quite possible it may breed upon Franz Josef Land.

Snowy owls at Cape Flora preyed upon the young of the loom, kittiwake, snow bunting and other birds, and I have frequently known them to kill adult kittiwakes.

We saw no lemmings, ptarmigans or willow grouse in Franz Josef Land.

JER-FALCON (*Hierofalco candicans*).—Dr. Neale saw a falcon which he believes to have been the Greenland Jer-Falcon (*Hierofalco candicans*) on the 24th of April 1882, near Cape Flora.

I did not meet with a hawk of any kind in Franz Josef Land, but Mr. Eagle Clarke thinks that the Greenland Jer-Falcon is the species which has occasionally been seen in Spitsbergen and Novaya Zemlia.

BRENT GOOSE (*Bernicla brenta*).—The first Brent Geese were seen in 1895 at midnight on June 8th. Mr. Armitage shot two on the thaw-water pond near the hut on Cape Flora on the 10th; and in 1896 I saw the first, a flock of eight on June 3rd, and on the 10th six more. None were seen after September 1st, 1895, when I succeeded in bagging two out of a large flock.

In 1896 none were seen after the middle of August.

Brents reappeared on Cape Flora on June 10th, 1887, when four were seen and one shot, and they put in an appearance intermittently in twos and threes throughout the summer, chiefly upon the grassy slopes at the east end of the plateau of Cape Flora, and at some thaw-water ponds at the western extreme of the Cape.

Dr. Neale, of Mr. Leigh Smith's expeditions, speaks of meeting with these geese and gives the date of their departure as September 22nd. We found no nests.

EIDER DUCK (*Somateria mollissima*).—The first seen of these birds was at Cape Gertrude on June 24th, 1895, when a duck and

a drake were obtained. They were alone. Two or three pairs were seen throughout the summer at Cape Flora and Cape Grant.

In 1896 another specimen was obtained, a drake, which I shot at the thaw-water ponds at the west end of Cape Flora on May 28th. On August 28th another single bird was reported to have been seen. On July 15th, 1897, a drake and duck were also seen.

On August 7th, 1897, an eider duck's nest was found upon Cape Mary Harmsworth containing two young birds and a nearly hatched egg, which I photographed. Afterwards a large number of ducks with their young were observed swimming in the water at the Northern extreme of the spit there.

Nowhere else in Franz Josef Land did we see them in any numbers.

TURNSTONE (*Streptilas interpres*).—When out with my gun on May 27th, 1896, by the thaw-water pond near the hut upon Cape Flora, I shot the only specimen of this bird seen by us during our three years' stay in Franz Josef Land.

Mr. Clarke remarks that it is probably a mere straggler, as it is a scarce bird in Novaya Zemlia, with which opinion I entirely agree.

BONAPARTE'S SANDPIPER (*Tringa fuscicollis*).—On June 28th, 1897, I saw a small Sandpiper near the thaw-water pond by the hut on Cape Flora, and called Mr. Wilton out to shoot it. None of us were able to identify this bird, but I learn from Mr. Eagle Clarke that it is a Bonaparte's Sandpiper. No other specimen of this American species was noticed, but it is more than possible that other examples had been mistaken for the Purple Sandpiper, which was common.

The smaller size and lighter colour caught my eye when it was in a sitting position, which would not be as noticeable when on the wing, so others may have previously escaped us. Mr. Clarke remarks: "This bird is not only a new and remarkable addition to the ornis of Franz Josef Land, but is the first authentic example of this American species that has been obtained in Europe elsewhere than the British Isles, for the Icelandic record is not regarded as satisfactory. The occurrence of this Sandpiper in Franz Josef Land, so far away from its accustomed haunts, is very remarkable ;

but almost equally remarkable is the fact that it should find its way there in the breeding season. It has only visited the British shores during the migratory period in the autumn, and its occurrence in Franz Josef Land in summer admits of no satisfactory explanation."

PURPLE SANDPIPER (*Arquatella maritima*).—These birds had left Franz Josef Land by September 8th, 1894, when we arrived at Cape Flora, for in this year the winter began unusually early. The first seen in 1895 was on June 8th, when I shot a single specimen, and I saw the last upon September 18th.

In 1896, I see by my journal, that the first Purple Sandpiper was seen on May 28th, and shot by me. They left us somewhat earlier in the autumn of this year than in 1895, all having departed by September 10th.

In 1897 the first seen were on May 27th, when three were noticed at the east end of the plateau upon Cape Flora.

The Purple Sandpiper nests upon Franz Josef Land, and Mr. Fisher, when botanising, found a nest and four eggs upon a raised beach covered with grasses upon Cape Flora, on June 25th. The young are hatched in July.

Payer is responsible for the introduction of the Knot (*Tringa canutus*) as a bird found in Franz Josef Land, and Colonel Feilden thinks that the "Brown Snipe" of Mr. Leigh Smith's expedition may be the Knot also.

Mr. Eagle Clarke very wisely concludes that both these references allude to the Purple Sandpiper. I believe that if the Knot visits Franz Josef Land we could not have failed to observe it.

The mating note of the Purple Sandpiper, which it emits when soaring to a low altitude, much like a Lark, is very beautiful.

SANDERLING (*Calidris arenaria*).—Although the occurrence of the Sanderling on Franz Josef Land is not improbable and Dr. Neale says that it was seen near Cape Flora, I never met with the species. It has not been noted from Novaya Zemlia, although it visits Spitsbergen.

ARCTIC TERN (*Sterna macrura*).—The first birds seen in 1895 were on June 20th, when I shot four specimens which were fishing in cracks in the sea ice at Cape Flora; the rest of the flock remained about the Cape for a few days, and then disappeared. Another

was shot on Bell Island on August 10th. After that none were seen until September 17th, when I observed a flock of five pass the hut on Cape Flora, evidently on their way south; and these were the last noticed that year.

I first saw Terns in 1896, on June 21st, fishing in cracks in the ice at the same spot as in 1895.

Two others were seen a few days later at the northern end of Windy Gully, hovering over the low sandy beach there. Thinking they might be nesting, I examined the ground carefully, but without success. The species has never been found breeding in Franz Josef Land, although it is more than possible that it does nest there. After the above date none were seen this year. On June 24th, 1897, I shot a male and female at Cape Flora.

ROSS'S GULL (*Rhodostethia rosea*).—I saw what I still believe to have been an example of Ross's gull on July 5th, 1897, and from my much longer experience of the Arctic avifauna and that of Franz Josef Land in particular, I am not likely to have fallen into the error of mistaking this bird for a Kittiwake, which Mr. Bruce apparently finds so easy.

Ross's gull bears little resemblance to the adult Kittiwake, as Mr. Bruce appears to imagine; and at that time of the year no young Kittiwakes were flying. The bird was *alone* when first I saw it, and did not mix with the Kittiwakes until after I had called my companion's attention to it.

Payer records having secured a specimen off the southern coast of Franz Josef Land, and, as is well known now, Dr. Nansen found the species in some numbers off Hvidtenland, to the north-east of the Archipelago.

GLAUCOUS GULL (*Larus glaucus*).—In common with other birds, the species left for the south earlier than usual in the autumn of 1894, and by September 16th all the young ones even had departed.

They returned again towards the middle of March, and on September 24th, 1895, the last of these birds (a young one) was seen. The last one observed in 1896 was on September 21st.

A couple or two of these birds we found nesting upon all the Capes reaching from Cape Flora to Cape Neale. They built as a rule on inaccessible points amongst the high basaltic cliffs. The

only eggs we obtained I secured on June 29th, 1896, when I found a pair nesting upon the top of the lower tier of rocks on Cape Flora. We captured several young birds at various times, and kept one alive in the hut through the winter of 1895 to 1896. The old birds defend their nest with considerable boldness. They preyed on the young looms, and on old looms, if the latter were wounded, as they did also upon any defenceless bird. This species is widely distributed all over the Archipelago.

Mr. Eagle Clarke points out that the birds seen by Dr. Nansen in the north-eastern portion of Franz Josef Land, and at first referred to by him as Herring Gulls, were doubtless *Larus glaucus*.

IVORY GULL (*Pagophila eburnea*).—This Gull we found to be fairly plentiful and widely distributed in Franz Josef Land, and I noticed it as far north as $81^{\circ} 19' 30''$ N. latitude in Cecil Rhodes Fjord, and as far east as Cape Cecil Harmsworth, and off the coast of Bromwich Island in Markham Sound, as far west as Cape Mary Harmsworth, the most westerly point of Franz Josef Land.

None were seen in the autumn of our arrival in 1894.

A number were reported to me as having been seen on March 5th, 1895, and I saw one as late in the autumn as October 14th, after which none were noticed. A number of young ones, however, put in an appearance between September 18th and October 6th, 1895.

In 1896 I did not see any, or hear of any being seen, until March 20th, and several young ones put in an appearance on April 22nd, and I saw one adult in Markham Sound on April 2nd. They had left us in the autumn by the end of the first week in October.

Mr. Leigh Smith ("Proc. Roy. Geogr. Soc." iii. p. 131) speaks of its nesting upon some low basaltic cliffs at May Island, where some young birds were captured.

The only other spot in Franz Josef Land which we had any reason to believe to be its nesting place is Cape Mary Harmsworth, where we landed on August 7th, 1897.

The Cape consists of a long stony spit formed of raised beaches in terraces, upon which is very little vegetation, projecting from the high ice-clad land behind. Deep water runs right up to the shore.

Immediately we landed we saw large numbers of shrieking and screaming Ivory Gulls collected in isolated colonies all over the two or three square miles of bare stony ground. As we advanced we saw patches of old moss in various directions, which proved to be nests of this gull. As we came up to them the birds became exceedingly excited, swooping down upon us with loud screeches and screams within a foot or two of our heads, and one or two of our party were even struck by them.

In nearly all cases the nests were empty owing to our late arrival, but a few contained young birds, and other young ones were running about in scores. Fortunately, a few nests had eggs in them still, and I collected twelve, two being handed to me by Dr. Koettlitz, which on arrival in England I handed over to an expert, for I feared to attempt to blow them on the spot, expecting to find large chicks in them. These eggs, however, proved to be addled. I am much indebted to Mr. F. W. Frohawk for the excellent manner he performed this anything but pleasant operation.

As we advanced across the tongue of land, we came upon other patches of nests, and as we approached, their owners took up the excitement and swooped and screeched in their vain endeavours to repel the invaders. The birds belonging to the previous colony quieted down as we left it, and their screeches and demonstrations ceased.

In nearly all cases the nests were empty, but in some I found a single egg, and in two cases two eggs.

The nests consisted of a low cone-shaped pile of dry moss, with here and there a white feather or two. They were 6 inches high, with a base of from 2 feet to 30 inches, in those I measured, with a slight depression at the top, where the eggs were laid. I took a number of photographs of these nests with the eggs and young birds; also one with the parent bird sitting on a nest containing two eggs, which I again photographed after it had flown off. I also took several photographs of the general aspect of the breeding ground. Had we been there a few weeks earlier we could literally have obtained hundreds of eggs. We took on board eight young birds, and seven of these reached the Thames on Sept. 3rd, 1897, but next day six were found dead. The remaining one I sent to the Zoological Society's Gardens in Regent's Park.

KITTIWAKE (*Rissa tridactyla*).—On our arrival at Cape Flora on Sept. 8th, 1894, we found a few young Kittiwakes still remaining, which stayed with us until near the end of the month.

I noted the first Kittiwake in 1895 on April 11th, while shooting Looms for the ship's company, and we saw the last for that year on September 30th: it was a young bird.

In 1896 the first individuals were observed on April 20th, and a flock of them was seen on the 26th. On September 12th, only a few remained, and all had left us again by September 25th. In 1897, the first lot of Kittiwakes were reported to have been seen on April 14th. On June 7th, 1895, I noticed that they had begun building on Cape Flora, and were carrying moss in their beaks from the slope of the talus. On June 17th, 1896, I looked into a number of nests on the rocks of Cape Flora and found that although the nests, or most of them, were completed, there were no eggs in any of them. On June 24th, Blomkvist and I obtained twenty-seven eggs, but two days later we found that most of the eggs we got on the 26th had been sat upon, and contained young. With one exception all the nests, which were roughly made of grasses and moss with a few feathers, contained one and two eggs, but in one case I found three eggs in a nest. We found them nesting in colonies amongst the Looms on the basaltic rocks, but as a rule they preferred the lower rocks below the Looms. We found this a very widely distributed bird in Franz Josef Land, nesting upon the southern rocks from Cape Flora to Cape Neale. On August 28th, 1896, Mr. Wilton and I captured seventeen Kittiwakes (three adults and the rest young ones which could fly). After attaching labels to some of them, I handed over the rest to Mr. Bruce to finish, in the hopes that they might be captured in some southern latitudes. I took many photographs of these birds nesting upon the rocks of Cape Flora.

RICHARDSON'S SKUA (*Stercorarius crepidatus*).—We saw none of these birds on our arrival in 1894.

They reached Cape Flora June 11th, 1895, when I shot two specimens. I also shot a young one on September 4th. The last example of these birds I saw on September 14th. In 1896 the first Skua was seen on June 13th, but none were noticed that autumn after September 9th. We found Richardson's Skua

nesting upon Bell Island on July 11th, 1895; upon Cape Grant on July 15th; on Cape Crowther on July 22nd, and discovered a nest upon Cape Neale two days later, which a bear had evidently helped himself to.

We obtained two eggs from each of the nests upon Bell Island, Cape Grant, and also on Cape Gertrude, and a single incubated egg from the nest upon Cape Crowther. I also shot the parent birds for specimens. On July 11th, we found a nest of Richardson's Skua with two eggs upon Cape Flora, which I photographed together with the parent birds. These Skuas defend their nest with great boldness, swooping down within a foot or two of the intruder, and alternating these tactics by performing all sorts of odd antics, such as pretending to be wounded to entice the enemy away. They prey upon Kittiwakes by chasing them, and making them throw up their food, which the pursuing Skua immediately swallows. I have even known them treat the Glaucous Gull in the same undignified manner. This species was the only Skua we saw actually upon Franz Josef Land.

POMATORHINE SKUA (*Stercorarius pomatorhinus*).—I saw and shot a number of these birds when in the ice to the east of Spitsbergen in latitude $77^{\circ} 30'$ N. and longitude $35^{\circ} 15'$ E. when on our way home, but none were ever observed on Franz Josef Land.

MANDT'S GUILLEMOT (*Uria mandti*).—This was the first bird to appear after the winter, and a few examples remained to the last, in the autumn, the species appearing on two occasions about or before the time the sun returned, and a few young ones in winter plumage were seen during three autumns a few days after, or about the time the sun had sunk for the long Arctic night.

In the autumn of 1894, I saw two Dovekies in the water at the edge of the floe off Cape Flora, partially in winter plumage, on October 23rd.

On February 25th, 1895, a flock was seen flying over the ice to the south of the Cape. On August 11th, of the same year I shot a young bird in the sea off the Cape, and on October 10th, a Dovekie in winter plumage was seen on the Gully Rocks.

In 1896 on February 24, I saw two partially in winter dress and on February 27, I saw a flock of about thirty, some partially in winter plumage, two entirely so, and one only in summer dress.

On October 20th, 1896, I saw eleven swimming about in the bay-ice, and succeeded in shooting two, an adult in winter plumage, and one young hen bird in winter dress also, with the legs nearly as red as in the adult, but with a tinge of brown in them still.

On October 22nd, Mr. Armitage killed three more.

We found this a widely distributed bird in Franz Josef Land, and noted it wherever our travels extended. We saw it in Cecil Rhodes Fjord and Leigh Smith Sound to the north, to the west off Cape Mary Harmsworth, and to the east in Markham Sound and near Cape Cecil Harmsworth. We found it nesting in small numbers amongst the Rotches, whose company it seemed to prefer as a rule. They nest in cracks upon the rocks of all the spots we visited on the southern coast from Cape Flora to Cape Neale, and I have no doubt that it breeds upon Capes Albert Markham, Richthofen, Fisher, McClintock, Bruce, Taylor, and St. Chad's Head, as I noticed birds at these places in the early spring. Its peculiar, short, plaintive and very distinctive note welcomed us at Cape Neale on our sledge journey in 1897.

LITTLE AUK (*Alle alle*).—This bird, with the exception of the Dovekie, was the first to return to us after the winter, and practically arrived with the Dovekie, but left earlier in the autumn. We saw none on our arrival in Franz Josef Land in 1894. I saw a flock on February 26th, 1895, and Dr. Koettlitz reported having seen some on the previous day. On March 5th, I shot a Rotche partially in winter dress. On March 6th, a few were on the cliffs of Cape Flora.

Both in 1895 and 1896 all the Little Auks or Rotches had departed by August 28th. On February 27th, 1896, Dr. Koettlitz saw a flock of Rotches off Cape Flora.

On March 6th, 1897, I saw a flock of seven fly over the ice to the south of Cape Flora; these were the first seen that year.

Mr. Eagle Clarke remarks as follows: "Dr. Nansen observed it to the north-east of Franz Josef Land in lat. 82° N. on the 10th of June, 1895, and on the 26th of June many were seen in the same latitude. At the Isles of Hvidtenland, on the 8th of August, a number of Little Auks were noted; and at Torup Island, on the 17th, there were 'myriads.'"

On the 10th of March, 1896, at his winter-quarters on Frederick Jackson Island, Dr. Nansen mentions that "millions" were seen flying up the sound at 6 A.M., and "when we went out at two in the afternoon there was an unceasing passage of flock after flock flying out to sea, and this continued until late in the afternoon." It was also observed (p. 410) that this species and the Black Guillemot invariably set forth from the land at certain times of the day towards the open sea, returning in broken lines to their nest-rocks again. At the basaltic cliffs of Cape Fisher, on the 3rd of June, 1896, "we found these birds breeding in swarms." Dr. Neale tells us that "the Little Auk departed from Cape Flora in the autumn of 1881 during the first week of September; and was first observed there in the spring of 1882 on the 2nd of March. It arrived at Frederick Jackson Island in 1896 on the 25th of February as related by Dr. Nansen."

We found this bird wherever we travelled in Franz Josef Land. I noted it at Cape Fisher and Cecil Rhodes Fjord in the spring of 1895, and in other spots; also near Cape Albert Markham, and in Vesey Hamilton Channel, besides many other places in the spring of 1896. In the spring of 1897 it was noticed upon the rocks of St. Chad's Head, in Leigh Smith Sound, and on the northern coast of western Franz Josef Land, flying over the Queen Victoria Sea. We found it nesting amongst the loose stones of the talus upon the following, Capes Neale, Crowther, Grant, and Stephen, and some in cracks in the rocks at these Capes.

It also nests in fissures of the rocks upon Cape Flora, the Gully Rocks, and Cape Crowther.

We found incubated eggs at Cape Grant on July 14th, 1895. The young remain in the nesting-place until fully fledged. I took many photographs from life of these birds.

[The occurrence of a Puffin (*Fratercula arctica*) rests on the authority of Payer. We saw none in Franz Josef Land.

It is a fairly common species in Spitsbergen but is not found in Novaya Zemlia.]

BRÜNNICH'S GUILLEMOT (*Uria arra*).—All Looms appeared to have departed when we reached Franz Josef Land on September 7th, 1894, but we saw eight solitary examples on September 23rd in a pool of water in the floes.

They reappeared in 1895, on March 19th, when I shot four specimens on the rocks of Cape Flora.

In the end of August 1895 and 1896 I shot many hundreds for food for the winter. By September 10th, 1895, all had departed, but the vast majority had gone on August 30th. On September 30th of that year, however, I saw a solitary young one on a piece of bay-ice which had evidently been left behind when others departed for the south. Looms returned in 1896, on April 1st, to Cape Flora, and I heard one or two amongst the rocks on that date on David Wilton Island, but the majority had gone by August 26th, although a few stragglers remained until the 30th. We found Looms nesting upon all the capes we visited along the southern coast in great numbers, with the exception of Capes Mary Harmsworth and Neale, and I have every reason to believe that they do so on the rocks bordering Mellenius Sound, as I saw Looms there in April. I also noticed them flying round Cape Fisher.

It occurred to me that it would be interesting to trace the migration of Looms, and with this object I captured nineteen young ones on the rocks of Cape Flora, and brought them back to the hut, where Mr. Bruce attached a small copper label, upon which was punched a letter J. We then set them free, placing them in the sea to give them a fair start. He took the temperature of a young one, which he informed me was 107.1° F.

We noticed young birds coming down from the cliffs of Cape Grant on August 3rd, they then fell a ready prey to the Glaucous Gulls and Snowy Owls. At Cape Flora the descent always commenced somewhat later and lasted until the end of August. It was a pretty sight to see the old birds helping the young ones down to the sea from the cliffs 600 feet above it. The young one would jump from the ledge, open its wings and parachute downwards; the old birds would accompany it on its flight, sometimes supporting it by holding it by its tail until the sea was reached. I have seen several old birds looking after one young one at the same time. Blomkvist and I secured for food, by climbing, many hundreds of eggs from the ledges upon which they rest without any protection in the way of a nest.

I took many photographs of Looms nesting upon the cliffs, and in the water with their young.

RED-THROATED DIVER (*Colymbus septentrionalis*).—On August 10th, 1895, I shot two of these birds on a shallow pond on Bell Island, and on the following day I killed a cock bird and a young one which were alone, on a similar pond on Mabel Island, a mile or so distant from the first. With the exception of a pair seen at Cape Gertrude on June 28th, 1896, they were the only examples we met with in Franz Josef Land.

I do not understand Dr. Neale's statement, as quoted by Mr. Eagle Clarke, who writes, "The Red-throated Diver has only come under the notice of Dr. Neale among all the previous explorers of Franz Josef Land. Rain-Geese (*Colymbus septentrionalis*), he tells us were seen and shot on the cliffs 700 feet above sea level, presumably at Cape Flora, but no nests were seen." Surely "on the cliffs" is a very unlikely position upon which to find Red-throated Divers?

FULMAR PETREL (*Fulmarus glacialis*).—A few of these birds remained at Cape Flora when we landed there on September 8th, 1894, and left us a few days later.

In 1895 I noticed the first "Mollymoke" on March 20th, and the last was seen on September 18th, when I shot a young one. In 1896 Blomkvist saw the first one of the year on March 13th, but in this year one specimen was seen on September 23rd. This bird was found to be widely distributed in Franz Josef Land, and we frequently saw it on May 1st, when sledging off Cape McClintock, and elsewhere. Also in the end of March, 1896, I often saw it skimming over the ice in Markham Sound and in the British Channel.

We found it nesting in colonies upon the rocks of Capes Crowther and Grant, and on the Cooke Rocks, in very inaccessible positions, and we saw it flying about the cliffs of Cape Fisher on April 28th, 1895.

Dr. Nansen mentions having seen it on June 16th, 1895, to the north-east of Franz Josef Land, and in August off Hvidtenland, and again on Frederick Jackson Island in September. Dr. Neale refers to the "molly" as a migratory bird, and mentions that it

remained at Cape Flora as late as October 28th, 1881, and returned on the 24th of April in the following spring.

NOTE: *Golden Plover* (*Charadrius pluvialis*).—This bird was not seen by us in Franz Josef Land, but I shot one from the deck of the *Windward* on our voyage there on August 17th, 1894, in latitude 70° 30' N. and longitude 50° 30' E., and secured it.

BOTANY OF FRANZ JOSEF LAND. BY HARRY FISHER.

PHÆNOGAMIA.

THE chief features of this remarkably insular flora are the absence of willows, sedges, the heath family, the mountain sorrel, the dandelion, the louseworts, and a few other species which in other Arctic regions attain a latitude as high as Franz Josef Land.

The presence of the rare and beautiful grass (*Pleuropogon Sabinii*, Br.) is quite as interesting as the absence of those plants above mentioned. This remarkable species was discovered by Captain (afterwards Sir Edward) Sabine at the winter quarters in the south of Melville Island, latitude $74^{\circ} 47'$ N., longitude $110^{\circ} 48'$ W., in 1819. Afterwards it was found in a few places in a south-easterly direction. Then Baer found it in Novaya Zemlia. Then in 1878 it was found in Actinia Bay, Taimur Island, by the Vega Expedition,* $76^{\circ} 15'$. Now that we have it from Franz Josef Archipelago, four degrees further north† than previous records, the distribution, which was always interesting, is now extremely so. We know now that there is a deep sea between Franz Josef Archipelago and the Polar American Islands. It seems probable that the migration is by way of Siberia, and not across the Pole. There is, however, nearly a hemisphere (155°) without a record. It should be carefully looked for between Taimur and Behring's Straits. You will notice that it is unknown from Grinnell Land,‡ Greenland, and Spitzbergen, and between Taimur Island and Melville Island.

Most of the islands are completely ice-capped, but on the southern side of a few there are bold headlands of basalt, which have an average height of 1000 ft., exclusive of the ice-cap. The upper half of these headlands is precipitous rock, the lower

* Kjellman. † $80^{\circ} 3'$ N. ‡ Excepting Cape York (Nathorst).

portion being composed of loose *débris*, in some cases down to the edge of the sea. In others we have extensive *débris* on the western side, almost bare of any vegetation ; the southern side being grassy and mossy, the eastern side being mossy towards the south and bare towards the north. The Phanerogams are almost confined to the south and south-east side of these headlands. At the base of the talus there is usually a raised beach, sometimes 400 yards wide, as on Cape Flora, but wanting in others, as on the south-east side of Cape Grant. On the west side of Cape Grant there are four raised beaches covered with moss (a doubtful fifth, probably belonging to the same age as the fourth). On Cape Stephen there are three. On Cape Flora there are three. On all of these there is a considerable amount of vegetation, chiefly mosses. In the wettest places they form lovely carpets of crimson, green, and gold.

There are similar raised beaches on other capes, varying in number, however. There is a fine corrie on Cape Stephen, and a smaller one on Cape Grant, but, as these are both on the western side, the flora is almost confined to a few lichens. There is a beautiful corrie on Mabel Island facing south. Here we have an improvement in the vegetation when compared with any other spot, excepting the fine beach on the south-eastern side of Cape Stephen. A corrie is a Scotch name for a hollow in a mountain. In the Highlands we look in the corries for the more interesting plants. They are the sources of the streams and rills which trickle down the mountain side.

In Franz Josef Archipelago corries are very bare of vegetation, probably because they are all on the colder side of the headlands. This remark cannot be applied to the one on Mabel Island, however. In the height of the summer these corries had about an inch of water in the middle of a patch of mud and grit—I mean the water was about an inch deep. This was surrounded by barren *débris*.

Below the raised beaches already named, we have the sea-beach of the present day, usually devoid of vegetation ; and even when the plants descend to the very edge of the sea, they are of no interest. Unlike other regions, we have here no maritime plants.

There is a cold current running along the southern shores of this archipelago from east to west (approximately), the ice clinging to the shore throughout the summer in many instances. When the ice does leave the shore, it is usually so late in the season that vegetation has no chance of existing, if it ever succeeded in establishing itself. I have only seen two spots where maritime plants might be expected, and these were separated from the sea by ice the whole time, excepting one month in 1895. Then the abundance of fresh water which is discharged into the sea at these two places named, renders the water too free of saline matter to encourage the growth of maritime plants, supposing they have ever existed there during similar climates to the present.

On the south-eastern side of Cape Gertrude there is a flat, sandy, marshy-looking beach only a few feet above the sea. I saw this first in September, 1894. It was then as hard as a road, and there was a little snow on it. It seemed to me a very promising place, so the next summer I went to look for those damp-loving plants which are well known to grow in latitudes quite as high as this. I was there on Cape Gertrude eight days, so that I had abundance of time to satisfy myself as to the vegetable life. It must be difficult for you to imagine a more desolate waste than this; not a single flowering plant—not a leaf of one—and this on the warmest side of the cape. On the south-western side of this cape I found a small flora, and on the south side, on raised beaches, there are small but beautiful patches of the purple saxifrage.

You will have come to the conclusion by this time that Franz Josef Archipelago is not a paradise for the lovers of flowers; but we must not take too gloomy a view of this forbidding-looking group of islands. In support of this statement, I must ask you to attend to the cryptogamic flora referred to later in this paper. Before passing to that, I must request you to consider a few remarks on the Phænogamia.

There are fourteen common Arctic plants, which find a home here in every possible place for a plant to grow, some of them of considerable beauty when compared with their stern surroundings; others of them do not flourish, but merely exist. Those plants which may be said to succeed the best here are well known

amongst the most Arctic species. I may mention them, as there are not many : *Papaver nudicaule** (yellow and white poppy), *Cardamine bellidifolia*, *Draba alpina*, *Cochlearia fenestrata*, *Cerastium alpinum*, *Saxifraga oppositifolia*, *Alopecurus alpinus*, *Phippsia algida*, and *Poa cenisia* All. vars.

Now I will mention the few plants which are scarce here : *Pleuropogon Sabinii* Br., in one pool only. *Sagina Linnæi* Presl., on Cape Neale only. *Arenaria sulcata* Schlecht, on three Capes, but very scarce indeed. *Saxifraga stellaris* L. Poir var. *comosa*. This is small, but looks like existing as long as most of the phænogams in the three spots where it grows. This is a high latitude for the last. *Graphephorum Fisheri*, Gray. *Poa abbreviata*, Br.

Cryptogamia

There are no vascular cryptogams. There are as many musci as we can expect, but very few species are fertile. There are lovely carpets of brilliant crimson, yellow, green, and golden mosses on the wet level raised beaches. Hepaticæ are poorly represented; the only conspicuous species—*Marchantia polymorpha*—although barren, is luxuriant from sea-level to 500 ft. on Capes Flora and Grant, but not elsewhere. Marine algæ are extremely scarce, and very difficult to obtain. I believe I have brought everything that it was possible to procure. The scarcity of open water makes it unusually difficult to procure these forms.

Fresh water algæ are more plentiful. I devoted much time and labour in collecting, examining, and preserving every species.

Lichens

These are fairly well represented, the most notable absentee being *Dactylina arctica*.

It is unnecessary to mention any but the most characteristic species. *Placodium elegans* is the one which most attracts the eye, and which gives a warm orange tint to the landscape in some places. Some boulders are almost covered with it, from the present sea-shore up to 600 ft. Then the cliffs are in many

* *P. radicum*, Rottb.

places decorated up to about 1000 ft. Snow melts very soon on boulders when this lichen is present in sunny places.

The next most characteristic species is *Neuropogon melaxanthus*, a pretty and interesting plant. I never saw this on rocks *in situ*. On loose boulders it is abundant up to 900 ft. This plant has a very wide distribution, although it is not found in all Arctic regions.

The *Gyrophora* group, known also as *Umbilicaria*, are here in great profusion, but many of the forms which are known in the Arctic do not occur here. One of the species is represented by a handsome variety (*G. Delisei*). These plants also ascend to 900 ft.

Thamnolia vermicularis, Sw., sometimes called macaroni lichen, is conspicuous at all elevations. There are large patches near sea-level, but the finest examples are in damp hollows on the talus at 500 ft. It ascends to 900 ft., but is small and much scarcer. At this elevation it is conspicuous owing to the great paucity of other plants, the only flowering plant which ascends to that height being *Phippsia algida*, a common Arctic grass. This does not flower, however, above 600 ft. Small tufts of leaves nearly an inch long are found at 900 ft. in one place.

Lecidea geographica is the only other lichen which is conspicuous at 900 ft.

Peltigera aphthosa is in profusion at low elevation. This is a very conspicuous plant, having the upper surface of the thallus an apple-green colour. There is a handsome variety of this, having its upper parts a fine bronze green, less easily fractured than the common form. I have not seen this form from any other region. There are other species of this genus, but they are neither conspicuous nor frequent.

I only found the pretty *Solornia crocea* in one spot. It is very small there.

It is sometimes difficult to obtain specimens of the saxicolous lichens, some of which only grow on round smooth boulders of basalt. I did, however, bring back specimens of them all.

Fungi are fairly well represented by *Hymenomycetes*.

The Protophyta are the most numerous forms. Some mossy pools abound with small organisms of this class, including "red

snow," which is very abundant in many places. Of the microscopic forms of this sub-division we now have a very interesting collection of the most Arctic forms. I collected examples in some quantity from many places. Diatoms, though very abundant, are not represented by a great variety of species. Desmids are remarkably scarce.

The above is a revised account of the Flora which was published in the *Geographical Journal* in 1896.

A SECOND short account appeared in the *Geographical Journal* in 1897 on the above subject.

Not any group of plants had then been thoroughly worked out. Quite recently Professor Cleve has published in Stockholm a full account with illustrations of some six new species and a few new varieties of Diatoms.

I have now finished a long examination of the flowering plants. There is not a single species that is new, and only four forms that have not been described. The most interesting plant is *Pleuropogon Sabinii* Br. because it is the only species here, unknown from Spitzbergen.

Sagina nivalis Fr. and *Saxifraga stellaria* reach their northern limit here.

Several of the species are extremely scarce and local, and much infested with a parasitic fungus. These plants flourish as far north as Advent Bay in Spitzbergen, but specimens from north of 80° in the latter, are very similar to those in Franz Josef Archipelago. The same may be said of plants collected by Kjellman on Kap Tschelyuskin the most northern point of Siberia. In fact there is scarcely any difference. It must be remembered that Franz Josef Archipelago is composed of small islands on and beyond 80° N., so that a few plants which exist on Kap Tschelyuskin and north Spitzbergen may have been on Franz Josef Archipelago, and have disappeared owing to slightly more unfavourable conditions prevailing there. The absence of the whole

group of Corolliflorals from Franz Josef Archipelago is remarkable.

The presence of seedlings of *Papaver radicum* Rottb.* *Draba leptopetala* Fr. and *Cochlearia* is interesting because I do not know of any record of seedlings from such a high latitude.

I have nothing additional to my remarks on the lichens in the *Geographical Journal* for December 1896. The examination of them is a long and difficult task.

The mosses are still under examination : they promise to be more interesting than I expected.

The fresh water algæ are almost ready for publication. Some remarkable species are here. One has only been found in the Faröe Isles and another in South Georgia, and some are new. The fungi have several interesting species, one of them being new.

I have previously mentioned Payer's collection, which was made in winter, and Mr. Leigh Smith with Dr. Neale and another, collected some nine flowers. These latter are mentioned by Sir Clements Markham in his account of Mr. Leigh Smith's voyages to Franz Josef Land.

Professor Cleve also mentions Payer's soundings off Franz Josef Land in his report (in English) on the Diatoms, handed over to him by myself.

A full report is now ready for presentation to the Linnean Society of the flowering plants of Franz Josef Archipelago.

* The name *P. nudicaule* L. is now applied to a much larger form found in Alpine Central and Eastern Asia.

NOTES ON THE METEOROLOGICAL OBSERVATIONS IN
FRANZ JOSEF LAND OF THE JACKSON-HARMSWORTH
POLAR EXPEDITION. BY A. B. ARMITAGE.

THE following remarks are written with a view to giving some idea of our methods of working, and do not claim to have any special scientific value. I commenced making regular four-hourly meteorological observations after we left Archangel in the *Windward*. They consisted of readings of the barometer; thermometer for the temperature of both air and water: hygrometers and hydrometers.

The force and direction of the wind; the proportion and direction of the clouds; their scientific nomenclature; the aspect of the sea in all its varied movements; and any other phenomena were all duly recorded in the books supplied to the Expedition by the Meteorological Office, where all meteorological data collected by the Expedition are being examined.

For instance, I find noted that on August 17th, 1894, in about latitude $70^{\circ} 44'$ N., longitude 52° E., heavy dark clouds were seen settling down on the eastern horizon with forked lightning and low, rumbling thunder. That was the last display (in that particular form) of such disturbances we were to see and hear for some years to come.

There is also recorded on the same date, the greatest difference in the specific gravity of the sea-surface, when amongst the ice, and *vice versâ*, which I have seen while in the Arctic seas; the scale reading in the former case being $12^{\circ}.5$, in the latter, 26° , and the sea-surface temperature $+39^{\circ}$ F.

During the ten weeks which had elapsed between the date of our arrival at Franz Josef Land, and that on which we took up our abode at the hut on Cape Flora, I continued to make my observations on board the *Windward*.

On November 17th, 1894, everything, including instruments, was on shore, and we proceeded to erect them in suitable positions for observing with during our prolonged stay in this country which, we all hoped, would yield no small number of its ice-bound secrets.

Our standard barometer was a Marine Mercurial lent to the Expedition, together with a number of other instruments, through the courtesy of Mr. R. Scott, F.R.S.

It was mounted in our common living-room, close to the S.E. window.

Near it, on our "sideboard," were one large aneroid barometer and three small pocket-aneroids, so that the aneroids which we used when travelling were constantly compared with the standard barometer.

Built against the S.W. corner of the hut was a small wooden structure, 5 feet by 4 feet by 4 feet, in which was mounted the George's Mercurial Mountain Barometer.

The thermometer screen was erected on the top of a cask, at a suitable distance from the hut, and steadied by boulders placed round the cask.

In it I mounted the registering thermometers, dry and wet bulb thermometers, and one of the meteorological office sling thermometers.

On the top of a stout pole fixed against the stable, and well above obstructions, was the anemometer, which, I am sorry to say, was worn out by the furious gales which hold their revels in an uncommon degree in that portion of the globe, some time before we left it.

All the readings of these various instruments were recorded day by day, as well as the usual phenomena previously detailed and any uncommon appearance in the aspect of the weather, the heavens, the earth, or the sea.

During the winter months these observations were made every four hours of the day—viz., 8 A.M. to 8 P.M. inclusive, with the exception of the last year, when only the four-hourly observations were taken.

I generally made all the four-hourly observations myself, with few exceptions; but during winter months, and while on the

exploring journeys, the other members of the Expedition assisted me.

I read the various instruments and noted the phenomena from 8 A.M. to 10 P.M., Mr. Jackson being responsible for those at midnight and 2 A.M., while during the first year Dr. Koettlitz, Messrs. Fisher and Child were alternately responsible for the 4 and 6 A.M. readings, and in the winter of the second year Dr. Koettlitz and Mr. Child undertook them.

During the spring journeys, on all of which I accompanied Mr. Jackson, the other members of the Expedition kept up the meteorological observations.

When on our boat journey in 1895, Heyward made all the observations at Cape Flora; and Mr. Bruce took charge of the meteorology while we were on a sledge journey of two months duration in the spring of 1897.

The care and accuracy with which they recorded them is evidence of their interest in the work.

In regard to our observations while travelling, I made them when possible, generally three or four times during the day.

When weather permitted, I placed a small box of registering instruments in a protected place after camping, and recorded the readings on turning out.

The pocket-aneroid barometer had a lively time of it on these occasions, for the weather was seldom similar for many hours together; and on our last spring journey the up and down glacier work seemed to demoralise it altogether. The thermometers, too, ran up and down the scale in a very energetic manner.

Our lowest registered reading while travelling was $-46^{\circ}.5$ F.

At Cape Flora it was -54° F.

There is a + correction of at least $7\frac{1}{2}^{\circ}$ on the -54° F. reading, which would make it $-46\frac{1}{2}^{\circ}$ F.

The maximum reading is fairly correct, merely needing $0^{\circ}.3$ to be taken from it.

Most of our instruments were examined and corrected at Kew Observatory, both before we left for the North and after returning from it. I made regular observations for the rain-band with a direct vision spectroscope during the last year of our stay and found it chiefly conspicuous by its absence.

All our instruments were, of course, the best that could be procured; but certain improvements are bound to suggest themselves after a long personal experience with them in such a climate.

At least two large thermometer screens (if possible, three) should accompany a Polar Expedition, together with as many sets of instruments to be mounted in them respectively; for with only one, as I can testify from experience, it is very difficult to keep the screen clear from snow (without injuring or disturbing the instrument), which drives through the smallest crevice and packs into a solid mass inside.

With more than one screen (they should be easily movable) while one set of thermometers is registering the temperature, the other can be thawing out in the hut or ship.

A barograph and thermograph, too, would add greatly to the meteorological results; and also two or three hand-anemometers, as well as a standard one.

The observers on Ben Nevis could give most valuable information to any expedition which has to work with snow as its constant companion. Perhaps the most interesting, and certainly the most beautiful phenomena which we observed in that northern land, were the auroral lights. The goddess was not so brilliant as I had preconceived her to be, except on comparatively rare occasions, the generally pale, straw-coloured tint of the lights being more appropriate, however, to the simile of the Esquimaux, who call them "the shades of the dead." In Franz Josef Land the auroral light, as a rule, made its appearance in the east, spreading in more or less arched bands to the westward, either across the zenith or at varying altitudes, with streamers shooting up from the arches towards the zenith, and then gradually fading away. At other times the streamers, meeting at a common point, would form a corona in the zenith and dance madly round the heavens, first one way and then another.

I have seen the arches intercrossing one another all over the heavens, chiefly from east to west. On occasion, of course, we had some very brilliant displays, quite unlike the ordinary ones.

For instance, I find noted on the 19th of December, 1895: "Aurora all day, in bands and streamers, culminating, at 8 P.M., in brilliant display from east to west, being of spiral, fan-like, and

circular shapes. Thick circular masses in west extreme sending out streamers with rapid, lateral movement to north, which again closed up into bands and moved laterally and rapidly to the southward and disappeared, appearing to rise as it did so.

I have seen the auroral light extinguish to our vision that of stars below the third magnitude and cast a shadow.

The most brilliant displays generally occurred during calms or, paradoxical though it seems, gales of wind ; also shortly before and after winds of great force.

Although I have frequently listened intently for any sound that might have been caused by the aurora, I have never heard any in the slightest degree.

When quite calm, however, the curious noises made by the motion of the ice almost deceived me into the belief that there was some sound emanating from the restless lights overhead, but it was not so.

I have stood outside the house and watched one of the grandest sights which nature has ever unfolded before the eyes of man (and I have seen many in diverse portions of the globe). It was what seemed to be a stupendous battle between the aurora and the wind.

The former would struggle up against the latter until it formed a semi-corona in the zenith, and appeared to struggle against the furious gusts of wind (which are so prevalent in Franz Josef Land) for some minutes, sending streamers out against the enemy, and then, finally being vanquished, gradually retreat before his repeated onslaughts to the place from whence it came.

The aurora had a marked effect upon the needle which was kept suspended in the magnetic observatory.

Before we left England a galley, which was being supplied to the *Windward*, was entirely fitted with brass.

On arriving at Franz Josef Land, we found that the observatory which had been built for the Expedition was entirely unsuited for a boisterous climate.

Then the galley, brass fitted, double walled, lined with felt, and about six feet square, came in very usefully as an observatory. Trap windows were cut in it ; and on December 4th, 1894, it

was landed and placed in a suitable position, its sides being north, south, east and west.

In it I have spent many hours, and could, by a rather elastic stretch of my imagination, fancy myself once again in the magnetic house at Kew.

I found the needle very erratic at times, especially when making the observations of vibration, deflection, and declination.

The last named varied nearly 6° . During the observations of declination the needle was much steadier.

Very great inconvenience was caused, both while working with the unifilar magnetometer and dip-circle, by the freezing of my breath on the glasses of the instruments, until I devised means of heating the observatory. A small copper oil lamp, of great heating power, would be most useful in such cases; and the house should be well warmed and dried before observing in it.

A small lamp of non-magnetic material placed on the reading telescope during the deflection observations, and opposite the unifilar when making observations of vibration and declination, is also necessary.

The observations of declination which I made on our journeys were fairly regular, although the cliffs, when very close to or on top of them, as well as occasional magnetic disturbances, sometimes affected the needle.

Marks for north and south I laid down by means of the theodolite and unifilar magnetometer.

For the purpose of observing for position, we were equipped with a six-inch transit theodolite, three aluminium sextants, and artificial horizons.

Our timekeepers consisted of one chronometer and four half-chronometer watches.

The chronometer was slung in the usual padded box. The chronometer kept capital time the whole three years.

The watch which I wore on my person behaved beautifully throughout, notwithstanding the rough travelling over the ice, crossing of glaciers, and immersion in water which, in common with its bearer, it had to undergo.

The position of "Elmwood," our base, from which were deter-

mined all meridian distances, was made by lunar distances, moon-culminating-stars, meridian, and circum-meridional altitudes of stars.

I can confidently recommend any one who aspires to quickness in observing to practice in a temperature of -30° F., with a light to moderate breeze blowing.

All instruments should have their eye-pieces fitted so as to keep the mouth and nostrils as far away as possible from the verniers.

The theodolite requires a lamp with a cistern that will contain enough oil to last an hour, well ventilated, and not liable to blow out at every little puff of wind.

On our journeys I had to use a sextant and artificial horizon. I cannot recommend aluminium for sextants up north.

A small theodolite would have been much better, for it is intensely aggravating to see a bright sun too low to use an artificial horizon, and not a vestige of any other.

It is poor business, too, using mercury in really low temperatures, to say nothing of the weight.

Difficulty, however, in observing, as well as in other things, but enhances the interest one may take in such work, by the pleasure that is felt in overcoming it, especially when helping, in however small a degree, to enlarge our knowledge of the world we live in.

When approaching Franz Josef Land, the difference between the position by observation and that by dead reckoning during forty-eight hours showed a current running south-west two knots per hour.

**SOME RESULTS OF METEOROLOGICAL OBSERVATIONS
MADE AT CAPE FLORA, FRANZ JOSEF LAND. BY
MR. STRACHAN, METEOROLOGICAL OFFICE, LONDON.**

At Cape Flora the sun sets for the last time about the middle of October, and is not again visible until the third week of February. From the date of the disappearance of the sun until the second week of November there is a period of two or three hours twilight about noon. From November to February midday and midnight are practically alike as regards light.

The climate generally is exceedingly misty. Snowstorms are very prevalent, and gales of wind are of continuous occurrence. The highest temperature at any time during the year was 42° , and the lowest experienced was 46° below zero.

Although the station has high land between north-west and north-east, the winds observed even from that quarter are regarded as reliable, as their direction as well as force were observed with special care. The true direction (not magnetic) was recorded.

The absence of winds from the southward, the azimuth, which was quite open to the ocean, is remarkable. The frequency of winds from the eastward and westward, with tendency northward, as well as their violence, are probably due to some extent to the configuration of the archipelago.

Gales and squalls of wind prevailed for days together and were often of extraordinary violence. They raised the snow so as to obscure all vision, so that at times it was impossible to say whether snow was actually falling or not. Doubtless some record of snowfall was thus lost. In the months when night observations were not taken it was not always practicable to record the duration of snowfall in the interval; the hours of snowing are accordingly defective, and were actually greater than shown by the record.

Some snow fell even in the height of summer about as often as rain. The duration of the rain has been counted with that of snow, though the frequencies are distinguished.

Openings in the ice, brought about by the tides, currents, and winds, gave rise to frost-smokes and mists, as well as the formation of stratus clouds. Hence the frequent record of this phenomena.

Table I. contains the mean values of atmospherical pressure. The diurnal range is shown to be very small, as for all parts of the Arctic region, but the observations are only sufficient to detect it at Cape Flora for the months of November, December, January, and February. One minimum and one maximum only are indicated for December and January; a secondary minimum and a secondary maximum are apparent in November and in February. The hours of these positions are very irregular. In December, 1894, the barometer averaged only 29.40 inches, but in the following February as much as 30.16.

Table II. gives the mean temperature of the air for the hours of observation. The diurnal range is only completely exhibited for the coldest months. In February, 1895, there was practically no diurnal range of temperature, and in other months it is merely two or three degrees. The coldest month was February, 1895, with a mean of minus 20.6° , though January, 1896, was nearly as cold, minus 19.6° . The warmest month was July, 1895, with a mean of 35° .

Table III. shows the greatest and least atmospherical pressure in each month, with the simultaneous temperature, wind and weather. The weather was uniformly clear and fine with the highest pressure; misty or snowy and windy with the lowest. The unprecedented pressure for any oceanic station, 31.23 inches, occurred in February, 1895, and the lowest observed was 28.16 in in the previous December, showing a total range of the mercurial column of 3.07 inches. The atmospherical pressure exceeded 31 inches from before noon February 5th, till nearly 10 A.M. of the 6th.

Table IV. shows the highest and lowest readings of the thermometer in each month, with the simultaneous observations of atmospherical pressure, wind and weather. The highest

temperature, 41.8° , occurred in July; the lowest, 45.5° below zero, in February, giving a range of temperature within the year 1895 of 87.3° . The highest temperatures were accompanied by overcast, misty, or snowy weather, except in summer, when the weather was clear with them. Conversely, the lowest temperatures occurred in very clear weather, except during summer, when the weather was misty or overcast. The monthly range of temperature exceeded 60° in February, and was only about 12° in July.

The barometrical observations have been corrected for instrumental errors, reduced to temperature 32° , and to the sea-level. The thermometrical results have been corrected for instrumental errors, as determined at the Kew Observatory.

The range of temperature was 87.3 ; in November, December, January, and February it averaged 53° ; March, April, and May 39° ; June, July, and August 14° ; September and October 31° . Thus the range of temperature is greatest in winter, least in summer.

The northern auroral lights were, especially in the winter, often of extraordinary splendour, and the phenomenon was constantly a subject of attentive observation. Careful descriptions of the displays were recorded, and the narrative will form an important part of the scientific work of the Expedition.

The extraordinary atmospherical pressure in February, 1895, gave the highest readings of the barometer ever experienced by British observers in any part of the world, though higher have been recorded in Russian Siberia, if their reductions to sea-level are reliable. There could be no mistake about those at Cape Flora, for they were confirmed by simultaneous readings of an auxiliary mercurial barometer and two good aneroids.

The detailed results of the meteorological observations will be given in the publication of the scientific work of the Expedition. The observations made during the sledge journeys will then also be printed.

Table V. is a summary for each month of the winds referred to sixteen points for direction, with their mean force by Beaufort's scale, 0 being calm, and the grades rising by units to 12, representing the most violent hurricane.

Table VI. is a summary for each month of the weather from the record kept in the Beaufort notations, together with the duration of snow, including rain if any, in hours.

Table VII. is a summary for each month of the kinds of clouds recorded, together with the monthly mean amount of cloud, by the scale 0 to 10, a cloudless sky being represented by 0, a sky entirely overcast by 10, the intervening figures being proportional amounts of cloud.

The contents of Tables V., VI. and VII. will be illustrated by the following concise account of the characteristics of the weather of each month :

September, 1894.—The first decade of this month was spent in the vicinity of the south coast of Franz Josef Land, seeking for an eligible spot for the station. It was late in the season for navigation. The mean temperature of the air was only 19° , that of the sea-surface water averaged $28^{\circ}.7$, and its specific gravity 1.0235. The winds were chiefly from N.E. to E., and frequent from N.W. The weather was generally overcast, and 112 hours of snowfall were counted.

October, 1894, had a mean temperature one degree below zero with prevalent winds between N. and E., moderate to strong, with frequent squalls. The weather was for the most part clear, and only $58\frac{1}{2}$ hours of snow were recorded.

November, 1894, had about the same mean temperature as October, but the range of the thermometer was greater and of the barometer also. There was more variation in the winds, but still chiefly between N.E. and E. There were fewer squalls, fairly clear weather, but 128 hours of snow.

December, 1894, had low, mean, atmospherical pressure, 29.4 inches. The mean temperature was minus 17° . The winds were mostly logged under W.N.W., N.W., N., N.E. and E. Squalls were frequent. The mean amount of cloud was only 4.4, and clear weather predominated, though there were 92 hours of snow.

January, 1895, had a mean temperature of minus $11^{\circ}.6$, though a large range. The most wind came from N.E., and E.S.E. moderate. Clear weather predominated, though there were $129\frac{1}{2}$ hours of snow.

February, 1895, the atmospherical pressure averaged 30.16 inches, and attained the remarkable height of 31.23. The mean temperature was the lowest of any month, minus $20^{\circ}.6$, with the largest range 62° , and the lowest observed temperature, minus $45^{\circ}.5$. With these extreme conditions the winds were chiefly from E. and N.W., the air was very clear, mean amount of cloud 3.6, and only 33 hours of snow.

March, 1895, had a mean temperature about minus 15° , a range of only 38° , a small range of the barometer, a prevalence of calms. The air was generally clear, the mean amount of cloud only 5.1, and 40 hours of snow.

April, 1895, the temperature was now rapidly rising, the mean being minus $1^{\circ}.5$. The winds and weather became more variable, with a good deal of mist, and snow during 70 hours.

May, 1895, atmospherical pressure was getting less, and the temperature higher. The mean temperature was about 17° , the range had fallen to 28° , and was never below zero. Winds came from all directions, and there were frequent squalls. The weather was mostly overcast, with much mist, and snow for 79 hours.

June, 1895, atmospherical pressure continued to decrease, and temperature to increase. The mean temperature was $32^{\circ}.4$, with a range of only 13° . The chief winds were from W.N.W. and N.W. This was the most foggy month. The weather was mostly overcast, misty, and there were $89\frac{1}{2}$ hours of snow. The amount of cloud, 8.9, was the largest.

July, 1895, had low atmospherical pressure, was the warmest month, with a mean temperature of 35° , and small range. The winds were variable and calms were frequent. Mist was very prevalent, and the sky was commonly overcast. Snow was more frequent than rain, and the hours of their duration were 46.

August, 1895, witnessed a decrease in temperature, the mean being at or about the freezing point. The winds were most frequent from the N.E. quadrant. The weather was overcast for the most part, with a good deal of mist. Snow was more frequent than rain, and the hours of their duration were $65\frac{1}{2}$. Cumulus clouds were noted on nineteen occasions.

September, 1895, had low atmospherical pressure, mean temperature 24° . The most frequent winds were from E.N.E. The

sky was commonly overcast, and a good deal of mist prevailed. Rain was noted 7 times, snow 24, and their duration was 67 hours.

October, 1895, had a mean temperature of $7^{\circ}.3$. The winds were chiefly from eastward. The weather was much clearer than it had lately been, but fog was rather frequent, though only 34 hours of snow were noted.

November, 1895, had low atmospherical pressure, mean temperature minus $7^{\circ}.8$, with large range in both these elements. The winds came chiefly from the N.W. and E.; calms were rather frequent. Much clear blue sky was experienced and only 45 hours of snow.

December, 1895, had low atmospherical pressure, and was a trifle warmer than November, though with a great range of temperature. The winds were chiefly from N.E and E. Calms were frequent. The sky was even clearer than in November, though 133 hours of snow were counted, and much mist prevailed. Squalls became rather frequent.

January, 1896, had very low atmospherical pressure, with a large range. The mean temperature was $19^{\circ}.6$ below zero. The winds were chiefly from the eastward and from N.N.W., fresh. Although the weather was excessively squally, much mist prevailed, and snow during 88 hours.

February, 1896, the range of the barometer and also of the thermometer were almost at their greatest extent. Atmospherical pressure was at the lowest, mean 29.39 inches. The mean temperature was $7^{\circ}.5$ below zero. This month was in striking contrast with the previous February, when the pressure was greatest and the air coldest. The winds predominated from eastward. The amount of cloud was moderate, but there was much mist, and snowing was reckoned at 89 hours.

March, 1896, had high atmospherical pressure, and was comparatively warm with mean temperature $8^{\circ}.8$, though the range was large. Calms were frequent, and the principal winds from eastward. The weather was for the most part overcast, misty, with much snow during 60 hours.

April, 1896, was comparatively warm with mean temperature $9^{\circ}.9$. The winds were chiefly from eastward. There was much clear sky though the hours of snow numbered 122.

May, 1896, had about the same mean temperature, $16^{\circ}.6$, as the previous May. The wind favoured all points of the compass. There was a good deal overcast, misty weather, and snow fell during $78\frac{1}{2}$ hours. Rain was noted 5 times, snow 23.

June, 1896, had mean temperature $30^{\circ}.3$, and the range was small. The winds were variable and squally. Rain was noted 6 times, snow 12, and their duration was 38 hours. This month had the most cumulus and cirrus clouds.

July, 1896, had mean temperature $33^{\circ}.6$, with a smaller range than any other month. The winds favoured all points of the compass. The weather was for the most part overcast and misty. Fog was noted 5 times. Rain was noted 11 times, snow 10, and their duration amounted to 47 hours.

August, 1896, had mean temperature 32° . The most frequent winds were from E.S.E., but they varied over the compass with occasional calms. The weather was often overcast and misty. Rain was noted 9 times, snow 14, and their duration amounted to $37\frac{1}{2}$ hours.

September, 1896, had mean temperature $26^{\circ}.3$. The winds were principally from northward, though they varied over the compass. The weather was mostly overcast, the amount of cloud being 8.8. Fog was noted once. Rain was noted once, snow 25 times, and their duration amounted to 46 hours.

TABLE I
MONTHLY MEAN ATMOSPHERIC PRESSURE AT CAPE FLORA, FRANZ JOSEF LAND

Hours.	1894.				1895.								
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.
2 A.M.	inches —	inches —	inches —	inches 29.411	inches 29.845	inches 30.150	inches —	inches —	inches —	inches —	inches —	inches —	inches —
4 "	29.857	29.736	29.761	.413	.866	.166	—	—	—	—	—	—	—
6 "	—	—	—	.402	.865	.165	—	—	—	—	—	—	—
8 "	.873	.745	.764	.389	.864	.160	30.027	29.875	29.725	29.697	29.672	29.867	29.563
10 "	—	—	—	.382	.872	.160	—	—	—	—	—	—	—
Noon	.874	.745	.772	.389	.880	.171	.045	.897	.727	.713	.683	.871	.599
2 P.M.	—	—	—	.392	.875	.172	—	—	—	—	—	—	—
4 "	.867	.727	.770	.398	.876	.171	.042	.902	.734	.718	.686	.866	.612
6 "	—	—	—	.412	.873	.165	—	—	—	—	—	—	—
8 "	.856	.734	.779	.418	.861	.163	.040	.912	.736	.706	.687	.863	.615
10 "	—	—	—	.423	.858	.159	—	—	—	—	—	—	—
Midt.	.862	.745	.785	.418	.846	.147	—	—	—	—	—	—	—
Means	29.865	29.739	29.772	29.404	29.865	30.162	—	—	—	—	—	—	—

APPENDIX

Hours.	1895.			1896.									
	Oct.	Nov.	Dec.	Jan.	Feb.	Feb. 1 to 18	March.	April.	May.	June.	July.	August.	Sept.
	inches	inches	inches	inches	inches	inches	inches	inches	inches	inches	inches	inches	inches
2 A.M.	—	29.613	29.682	29.456	—	29.445	—	—	—	—	—	—	—
4 "	—	.606	.683	.452	—	.433	—	—	—	—	—	—	—
6 "	—	.597	.679	.448	—	.412	—	—	—	—	—	—	—
8 "	29.870	.595	.681	.444	29.370	—	30.049	29.934	29.890	29.887	29.823	29.819	29.817
10 "	—	.601	.684	.451	—	.369	—	—	—	—	—	—	—
Noon	.895	.610	.690	.458	.380	—	.067	.951	.902	.896	.837	.827	.821
2 P.M.	—	.615	.695	.463	—	.373	—	—	—	—	—	—	—
4 "	.890	.610	.694	.468	.399	—	.070	.948	.894	.893	.838	.838	.818
6 "	—	.608	.689	.471	—	.384	—	—	—	—	—	—	—
8 "	.890	.608	.685	.470	.401	—	.066	.943	.881	.900	.835	.837	.813
10 "	—	.612	.683	.473	—	.390	—	—	—	—	—	—	—
Midt.	—	.613	.686	.471	—	.386	—	—	—	—	—	—	—
Means	—	29.607	29.686	29.460	—	—	—	—	—	—	—	—	—

Aneroid † 573 used till November 22nd, when the barometer showed it to be practically correct.
July, 1896, no observations 26th and 27th.
August, 1896, only thirteen observations at 8 A.M., value obtained by differences.

TABLE II
MONTHLY MEAN TEMPERATURES OF THE AIR AT CAPE FLORA, FRANZ JOSEF LAND

Hours.	1894.				1895.								
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.
	°	°	°	°	°	°	°	°	°	°	°	°	°
2 A.M.	—	—	—	- 17.8	- 11.7	- 20.5	—	—	—	—	—	—	—
4 "	17.9	- 1.9	- 1.2	- 17.2	- 12.7	- 20.7	—	—	—	—	—	—	—
6 "	—	—	—	- 17.1	- 13.2	- 20.9	—	—	—	—	—	—	—
8 "	19.5	- 1.6	- 1.3	- 16.7	- 13.0	- 20.5	- 14.6	- 2.0	16.2	32.1	34.5	32.9	23.8
10 "	—	—	—	- 16.4	- 12.6	- 20.3	—	—	—	—	—	—	—
Noon	20.0	- 1.3	- 1.1	- 15.8	- 12.0	- 20.5	- 14.0	- 0.4	17.7	32.6	35.3	33.4	24.5
2 P.M.	—	—	—	- 15.3	- 11.4	- 20.5	—	—	—	—	—	—	—
4 "	20.1	- 1.1	- 0.3	- 16.0	- 10.9	- 20.7	- 15.2	- 1.1	17.2	32.5	35.9	32.7	24.2
6 "	—	—	—	- 16.5	- 10.3	- 20.7	—	—	—	—	—	—	—
8 "	19.6	- 1.3	- 0.7	- 17.0	- 9.9	- 20.6	- 16.3	- 2.7	16.2	32.1	34.3	32.5	23.3
10 "	—	—	—	- 17.7	- 10.7	- 20.8	—	—	—	—	—	—	—
Midt.	18.6	- 0.8	- 1.3	- 17.9	- 10.6	- 20.4	—	—	—	—	—	—	—
Means	19.3	- 1.3	- 1.0	- 16.8	- 11.6	- 20.6	—	—	—	—	—	—	—

APPENDIX

Hours.	1895.			1896.									
	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Feb. 1 to 18.
2 A.M.	°	°	°	°	°	°	°	°	°	°	°	°	°
4 "	—	— 8.0	— 6.7	— 19.6	—	—	—	—	—	—	—	—	— 11.7
6 "	—	— 7.7	— 6.0	— 20.0	—	—	—	—	—	—	—	—	— 12.3
8 "	—	— 7.7	— 6.2	— 20.2	—	—	—	—	—	—	—	—	— 12.0
10 "	7.4	— 7.2	— 7.2	— 19.3	— 7.3	7.6	8.5	15.2	30.0	33.8	31.7	26.2	—
Noon	—	— 7.6	— 7.0	— 19.1	—	—	—	—	—	—	—	—	— 11.5
2 P.M.	7.6	— 7.7	— 6.6	— 18.9	— 7.0	9.2	10.7	16.9	30.6	34.1	32.7	26.6	—
4 "	—	— 7.8	— 5.8	— 19.7	—	—	—	—	—	—	—	—	— 10.0
6 "	7.4	— 7.6	— 6.1	— 19.3	— 8.7	9.3	10.9	17.8	30.9	33.8	32.2	26.7	—
8 "	—	— 7.4	— 6.1	— 20.0	—	—	—	—	—	—	—	—	— 10.9
10 "	7.0	— 7.9	— 6.1	— 19.8	— 7.0	8.9	9.4	16.7	29.9	32.9	31.2	25.9	—
Midt.	—	— 8.4	— 6.2	— 19.3	—	—	—	—	—	—	—	—	— 11.8
	—	— 8.8	— 6.6	— 19.6	—	—	—	—	—	—	—	—	— 11.3
Means	—	— 7.8	— 6.4	— 19.6	—	—	—	—	—	—	—	—	—

November, 1894, the thermometer not observed 21st to 24th inclusive, when it was placed in a screen twelve yards from the house, and five feet above the ground on a cask.

TABLE III
EXTREMES OF ATMOSPHERIC PRESSURE, WITH ACCOMPANYING TEMPERATURE, WIND AND WEATHER, AT CAPE FLORA, FRANZ JOSEF LAND

Month.	Date.	Highest.	Temp.	Wind.	Weather.	Date.	Lowest.	Temp.	Wind.	Weather.	Range.
September 1894	d. h.	inches	°			d. h.	inches	°			inch
October	25 M	30.50	4.8	ESE 2	bc	15 8	29.05	21.1	Ebs 9	s	1.45
November	8 N	30.32	4.6	E 1	bc	27 M	29.26	0.6	NE 9	bcq	1.06
December	16 N	30.40	15.3	SSW 2	o	24 2	28.73	?	ESE 2	s	1.67
January 1895	- 16	30.15	7.8	E 4	b	21 2	28.16	14.8	SW 2	s	1.99
February	20 8	30.47	-	E 1	b	14 2	28.97	5.1	NE 7	ms	1.50
March	5 M	31.23	-	NNW 2	bv	27 16	29.43	23.8	NNE 9	b	1.80
April	9 N	30.54	-	Calm	b	13 20	29.57	-	NWbN 3	cm	0.97
May	10 N	30.43	-	SE 3	bv	23 20	28.80	5.5	NE 6	ms	1.63
June	16 N	30.08	19.2	NE 6	bv	20 8	28.93	24.6	Calm	ms	1.15
July	18 4	30.31	34.1	NW 5	bc	7 20	29.32	33.3	ESE 3	sf	0.99
August	10 4	30.05	37.3	Calm	bc	29 4	28.95	33.1	NbW 6	cbm	1.10
September	14 N	30.37	35.1	SW 1	o	30 20	29.18	35.3	NE 6	mr	1.19
October	25 4	29.97	5.5	ESE 3	ms	19 20	29.22	23.1	N 7	msq	0.75
November	26 N	30.49	10.4	E 4	cbm	29 8	29.27	-	NNW 4	bcm	1.22
December	25 8	30.34	-	NE 5	bv	29 6	28.92	-	NEbN 4	ms	1.42
January 1896	26 2	30.33	-	Calm	bv	10 4	28.91	-	NNE 5	msq	1.42
February	27 22	30.20	-	NW 1	o	6 20	28.39	-	ENE 8	msq	1.81
March	20 8	30.21	-	Calm	bc	2 N	28.25	-	SSE 5	ms	1.96
April	10 N	30.65	20.2	SSW 1	cbm	24 8	29.56	-	E 7	m	0.99
May	19 N	30.22	1.0	E 3	bcv	8 20	29.40	-	ESE 7	m	0.82
June	1 8	30.35	1.0	ESE 2	o	29 8	28.85	28.5	NNW 4	ms	1.50
July	14 N	30.10	32.2	SSE 2	bv	1 4	28.87	30.0	WSW 2	o	1.23
August	8 4	30.22	32.0	S 1	cbm	22 8	29.24	31.5	SE 4	md	0.98
September	28 N	30.23	36.5	NW 1	cbv	4 8	29.11	31.0	S 2	mr	1.12
	24 N	30.19	32.5	N 1	cb	30 8	29.07	33.0	Ebs 3	m	1.12
Period	Feb.	31.23	-	-	-	Dec.	28.16	-	-	-	3.07

The barometer was above thirty-one inches from before noon February 5th till near 10 A.M. 6th, 1895.

TABLE IV
EXTREMES OF AIR TEMPERATURE, WITH ACCOMPANYING PRESSURE, WIND, AND WEATHER,
AT CAPE FLORA, FRANZ JOSEF LAND

Month.	Date.	Max.	Bar.	Wind.	Weather.	Date.	Min.	Bar.	Wind.	Weather.	Range.
September 1894	d. h.	°	inches			d. h.	°	inches			°
October "	4 N	34.4	30.12	NE 1	o	29 16	0.6	30.00	E 1	om	33.8
November "	3 N	19.0	29.38	ENE 6	ms	12 4	- 11.9	29.60	N 9	bcq	30.9
December "	20 8	35.0	29.52	W 1	md	11 16	- 25.8	29.78	NE 5	bc	60.8
January 1895	21 2	14.8	28.16	SW 2	s	29 16	- 36.6	29.46	N 5	b	51.4
February "	10 M	26.1	29.73	NbW 2	o	21 10	- 30.5	30.18	ESE 2	b	56.6
March "	6 20	16.3	30.50	Calm	s	20 10	- 45.5	29.99	Calm	b	61.8
April "	31 4	7.5	29.69	ESE 2	ms	15 8	- 30.5	29.85	SE 1	b	38.0
May "	29 N	25.3	29.64	SW 1	ms	7 20	- 13.6	30.26	ESE 4	b	38.9
June "	2 N	32.6	29.53	WbN 2	m	6 8	4.6	29.66	ESE 2	ms	28.0
July "	30 8	37.0	29.67	NNW 2	b	1 8	24.0	30.03	WNW 3	c	13.0
August "	23 4	41.8	29.76	SSE 1	b	24 8	28.8	29.78	Calm	m	13.0
September "	4 20	41.2	30.07	NNE 4	bc	28 N	25.0	29.53	ENE 4	bc	16.2
October "	9 8	40.6	29.71	ENE 4	o	25 8	3.6	29.96	ESE 3	m	37.0
November "	8 8	22.9	30.17	SE 2	m	2 20	- 13.1	29.66	NW 4	b	36.0
December "	1 8	13.9	29.29	NbE 2	s	23 4	- 27.0	29.71	EbS 6	b	40.9
January 1896	11 8	15.3	29.13	E 4	s	31 6	- 35.6	29.54	NW 2	b	50.9
February "	18 2	6.5	29.75	E 6	s	13 8	- 39.5	29.49	Calm	b	46.0
March "	27 8	30.3	28.90	SW 6	ms	19 8	- 29.7	29.63	NNW 4	b	60.0
April "	8 20	29.1	30.30	Calm	m	- 20	- 23.9	29.86	NW 1	b	53.0
May "	9 4	29.1	29.57	SbW 2	ms	20 20	- 8.0	30.01	E 5	cbm	37.1
June "	26 8	33.0	29.44	SE 5	ms	7 8	4.0	29.98	W 4	bcq	37.0
July "	12 8	40.0	30.07	NW 1	bv	5 20	23.0	29.91	NW 2	msq	17.0
August "	13 N	40.0	29.84	NE 5	cbq	17 8	29.0	29.92	WNW 3	m	11.0
September "	26 4	40.0	30.18	N 1	bc	12 8	26.0	29.93	NEbN 6	bc	14.0
	30 8	33.0	29.08	EbS 3	m	19 8	17.0	29.95	ESE 1	c	16.0
Period	July	41.8	—	—	—	Feb.	- 45.5	—	—	—	87.3

TABLE V

SUMMARY OF WINDS, REFERRED TO SIXTEEN POINTS, WITH

Month.	N		NNE		NE		ENE		E		ESE		SE		SSE	
	O	F	O	F	O	F	O	F	O	F	O	F	O	F	O	F
1894																
September . .	30	4.7	6	6.5	18	3.0	5	3.8	20	2.4	4	3.5	8	2.0	1	1.0
October . . .	18	4.6	19	5.5	59	5.9	13	3.5	28	2.3	3	6.7	12	3.0	—	—
November . .	18	3.1	1	2.0	30	4.0	32	4.3	26	3.7	9	3.9	8	4.9	3	3.3
December . .	50	3.6	11	4.0	36	4.0	26	4.0	66	4.2	2	2.0	1	1.0	—	—
1895																
January . . .	23	3.0	14	3.4	55	4.5	13	2.7	59	3.7	48	3.2	19	1.8	—	—
February . .	17	2.1	25	6.2	31	3.4	15	3.7	41	3.7	31	2.8	6	2.0	—	—
March . . .	4	2.5	3	4.0	8	4.5	8	3.0	7	3.1	10	3.5	7	2.6	—	—
April . . .	5	4.0	6	5.7	11	4.6	6	4.3	14	5.1	16	2.9	3	1.7	2	2.0
May . . .	8	5.0	2	3.5	8	4.5	3	2.0	17	2.5	7	4.9	3	2.7	2	2.5
June . . .	8	2.9	3	3.0	3	2.0	—	—	4	2.0	16	2.6	6	1.8	—	—
July . . .	3	4.0	6	4.2	1	4.0	2	5.0	5	3.4	6	1.2	4	2.0	2	1.5
August . . .	1	1.0	10	4.0	6	5.2	14	3.1	8	1.8	17	4.0	5	2.2	2	2.0
September . .	11	5.8	5	3.8	6	4.2	32	3.1	5	2.4	5	2.2	4	2.2	—	—
October . . .	2	3.0	3	5.0	3	6.3	24	3.8	35	5.3	3	6.0	1	2.0	—	—
November . .	22	3.3	17	3.4	26	4.0	19	5.8	76	6.4	20	5.0	9	2.6	—	—
December . .	14	3.0	12	4.5	44	5.7	19	5.3	71	4.6	55	3.8	11	3.8	4	2.0
1896																
January . . .	24	5.9	17	4.8	38	4.3	11	3.7	52	6.0	61	4.9	6	3.0	—	—
February . .	17	3.4	20	4.2	34	4.6	14	4.0	44	5.0	35	4.5	7	5.4	6	3.0
March . . .	4	1.0	2	3.5	2	2.5	2	4.0	24	4.3	21	4.6	14	2.7	6	2.0
April . . .	—	—	1	2.0	8	5.1	13	4.9	36	4.4	26	5.1	13	2.1	1	1.0
May . . .	1	4.0	2	4.5	4	5.7	6	3.7	14	3.1	12	3.0	8	3.2	3	2.0
June . . .	7	4.9	2	6.5	9	4.6	—	—	12	3.1	6	2.2	10	3.2	8	1.4
July . . .	6	2.7	1	2.0	7	5.4	2	2.5	14	3.4	15	3.5	10	2.0	2	1.5
August . . .	8	2.4	—	—	6	3.2	1	1.0	6	3.5	26	3.2	10	1.9	5	1.6
September . .	11	2.4	4	1.8	10	2.5	2	2.0	10	3.2	13	3.6	3	2.7	2	2.0
October . . .	3	4.0	—	—	1	4.0	5	3.2	5	3.0	6	3.0	—	—	—	—

TABLE V

MEAN FORCE (SCALE 0-12), AT CAPE FLORA, FRANZ JOSEF LAND

S		SSW		SW		WSW		W		WNW		NW		NNW		No. of Calms.	No. of Observations.
O	F	O	F	O	F	O	F	O	F	O	F	O	F	O	F		
10	2.7	6	3.0	8	3.6	7	3.1	9	3.2	9	2.4	20	3.1	9	2.1	10	180
2	3.5	—	—	6	1.3	1	1.0	1	7.0	—	—	2	6.5	5	6.2	17	186
3	1.7	2	3.0	3	1.3	—	—	14	2.2	1	6.0	13	4.4	5	2.0	12	180
2	1.5	—	—	2	3.0	1	1.0	12	2.8	47	4.3	58	3.6	13	3.1	45	372
2	1.5	1	2.0	7	2.0	5	1.4	20	1.6	8	2.1	21	2.9	24	3.5	53	372
—	—	—	—	3	1.7	—	—	9	5.1	13	2.5	34	3.2	22	2.4	89	336
1	2.0	—	—	1	1.0	2	1.5	3	2.7	6	4.0	9	3.3	2	4.5	53	124
4	1.0	1	1.0	5	1.0	2	2.0	4	1.8	3	2.7	2	2.0	3	4.3	33	120
1	1.0	3	1.3	5	1.4	5	4.4	6	2.0	6	3.3	11	3.6	23	4.0	14	124
1	1.0	4	1.5	4	1.5	—	—	2	4.5	26	2.4	22	3.6	13	2.8	8	120
—	—	2	2.0	1	1.0	3	2.3	6	2.2	12	2.0	14	3.1	7	3.0	50	124
1	1.0	2	1.5	1	1.0	5	3.0	10	2.5	9	2.1	6	1.8	2	1.0	25	124
5	1.8	—	—	4	2.7	2	3.5	6	3.0	4	4.0	7	5.0	5	5.4	19	120
—	—	—	—	2	1.0	—	—	4	2.5	9	3.4	17	3.9	11	3.9	10	124
—	—	—	—	—	—	1	2.0	9	1.6	11	2.9	42	4.7	37	4.5	71	360
—	—	1	1.0	—	—	—	—	6	2.0	6	2.7	16	2.2	29	3.0	84	372
1	1.0	—	—	7	5.3	—	—	8	2.6	14	5.7	27	6.2	45	6.0	61	372
8	2.1	4	2.2	3	3.3	1	5.0	2	3.0	5	4.4	14	5.4	20	3.6	26	260
4	2.0	1	1.0	3	1.3	1	2.0	7	2.6	5	2.2	1	1.0	1	1.0	26	124
3	2.3	3	1.3	—	—	1	2.0	4	1.2	2	3.0	3	1.0	2	2.0	4	120
3	1.7	1	1.0	3	1.3	4	1.7	15	3.0	13	2.8	16	2.4	10	2.3	9	124
3	1.0	2	1.5	5	1.0	4	2.5	15	3.2	8	2.8	20	2.9	5	3.8	4	120
4	3.7	2	1.5	6	1.5	2	1.0	10	2.1	19	2.3	14	2.7	9	3.0	1	124
6	2.2	1	2.0	1	1.0	2	3.5	7	3.9	5	2.8	17	1.8	12	3.1	11	124
4	1.0	2	2.0	1	1.0	1	1.0	3	1.7	13	2.1	18	3.4	10	3.6	13	120
—	—	—	—	1	2.0	—	—	2	3.0	2	4.5	6	3.7	1	6.0	—	32

TABLE VI

SUMMARY OF WEATHER NOTATIONS AT CAPE FLORA,
FRANZ JOSEF LAND

Month.	No. of Obs.	b	c	o	m	f	r	s	Hours of snow.	q
1894										
September	180	26	44	110	22	—	—	46	112	6
October	186	71	62	53	32	3	—	19	58½	51
November	180	71	22	87	8	—	—	36	128	13
December	372	220	64	88	41	—	—	54	92	56
1895										
January	372	200	46	126	39	—	—	74	129½	11
February	336	227	40	69	29	—	—	23	33	31
March	124	90	18	16	20	—	—	13	40	11
April	120	55	22	43	48	3	—	19	70	10
May	124	33	33	58	40	—	—	29	79	21
June	120	9	25	86	38	18	3	23	89½	5
July	124	17	29	78	69	3	8	10	46	11
August	124	11	26	87	53	3	10	16	65½	13
September	120	12	25	83	51	2	7	24	67	15
October	124	25	30	69	48	8	—	17	34	13
November	360	173	53	134	92	—	—	35	45	13
December	372	150	54	168	163	—	—	108	133	37
1896										
January	372	126	74	172	198	—	—	63	88	87
February	260	97	55	108	129	—	—	62	89	37
March	124	16	21	87	91	—	—	47	60	1
April	120	42	17	61	66	—	—	31	122	9
May	124	25	24	75	64	—	5	23	78½	6
June	120	20	39	61	59	1	6	12	38	32
July	120	12	18	90	78	5	11	10	47	7
August	124	8	32	84	53	—	9	14	37½	5
September	120	4	39	77	25	1	1	25	46	4

Many hours of snow were not recorded in October, 1895.
February 26th, 1896, midday, hail for one hour and a half, size ●, included with snow.
Durations of snow frequently went unrecorded in March, June, July, and August, 1896.
July 26th, 1896, no observations.
The duration of rain is summed with that of snow.

TABLE VII

SUMMARY OF CLOUD NOTATIONS AT CAPE FLORA,
FRANZ JOSEF LAND

Month.	Mean Amount.	Cir	Cir-c	Cir-s	Cum	Cum-s	Str.	Nim	Nil	No. of Obs.
1894										
September	8.1	2	2	20	15	31	84	23	3	180
October	5.8	2	16	50	4	6	93	11	4	186
November	6.4	2	8	14	7	7	106	28	8	180
December	4.4	1	5	41	15	6	189	47	68	372
1895										
January	5.1	6	9	39	11	12	168	72	55	372
February	3.6	3	7	81	8	16	109	21	91	336
March	3.1	6	10	48	8	1	12	12	27	124
April	5.3	9	3	17	10	4	32	23	22	120
May	6.8	13	3	15	11	22	27	32	1	124
June	8.9	5	4	7	11	21	56	16	—	120
July	8.0	4	7	11	17	23	49	12	1	124
August	8.6	3	6	7	19	27	42	20	—	124
September	8.4	5	7	12	13	17	48	18	—	120
October	7.5	11	4	23	7	7	60	12	—	124
November	5.2	8	7	43	17	6	171	49	59	360
December	4.8	10	8	27	20	7	145	106	49	372
1896										
January	6.3	9	7	26	4	7	236	62	21	372
February	5.9	15	7	33	11	8	119	61	6	260
March	8.4	4	5	15	4	9	51	36	—	124
April	6.6	12	4	20	7	8	32	29	8	120
May	7.7	7	4	14	16	13	45	23	2	124
June	7.7	17	6	5	19	6	48	17	2	120
July	8.5	5	3	6	8	10	61	18	5	116
August	8.6	7	9	8	13	23	50	14	—	124
September	8.8	8	17	6	4	30	38	17	—	120

Snow fell in every month, rain in June, July, August, and September, but only occasionally. Fog occurred in the warmer months, mist was very common. There was an appreciable amount of cumulus. Meteorologists have yet to explain the presence of that cloud in an atmosphere below the freezing point of water, and even below zero.

REMARKS, ETC.

SEPTEMBER, 1894.

- 1st. In latitude $79^{\circ} 9'$ N., longitude $45^{\circ} 10'$ E., the sea exceedingly smooth and oily.
8 P.M. Quantities of young ice formed on the water during the night.
- 3rd. 2 A.M. Sighted Cape Neale, stood to N.E. to clear ice.
4.30. Stopped by ice barrier about forty miles to southward of Cape Grant.
10. Ice fast and unbroken right up to the land.
8 P.M. Frequently running into bights, and steering various courses out of them.
- 4th. 8 A.M. Through loose ice.
3.30 P.M. Water more clear.
MDN. Proceeding N.E. through channel of open water.
- 5th. 4.30 A.M. Stopped by fast ice. Bell Island bearing about N.E., distant 30 miles.
8. Rammed bay-ice, and proceeded through it for four hours.
4 P.M. At sunset a brilliant shaft of light was thrown to about 5° altitude, perpendicularly above sun.
MDN. Ice parting; proceeded to N.E. through very tough young ice, two to three inches in thickness.
- 6th. 5 A.M. Anchored to floe; thick fog.
8 P.M. Ice cracking.
MDN. Floe drifting into ship; shifted position.
- 7th. 4 A.M. Ramming ice; broke through; anchored to floe.
8.45. Forced ship through ice, and proceeded.
NOON. Bell Island bore N. 35° W. $1\frac{1}{4}$ mile. Sounded in 30 fms.; fine sand. Proceeded up Miers Channel.
5.30 P.M. Sounded 57 fms., mud, Windward Island bearing S. 30° E., $\frac{1}{4}$ mile.

- 8th. 4 A.M. Proceeded across Mier's Channel to N.W. point of Northbrook Island.
NOON. No bottom at 100 fms. Proceeded down channel.
5.30 P.M. Off Cape Flora. Wind blowing from gullies in fierce gusts.
- 9th. 5 A.M. Fast to floe three miles W. of Cape Barents.
NOON. Driven off Cape Barents, and made fast to floe about two cables distant from precipitous cliffs 150 ft. high. Second engineer thought the ship scraped rock. Sounded all round: 16 to 7 fms., sea-shells, black gravel (basaltic) and rocks.
- 10th. 3 A.M. Off Cape Flora, fast to floe.
10. Sounded off land floe, south point of Cape Flora, obtaining 16 to 5 fms. Made fast to floe and a small berg in 5 fms., at most suitable place for landing gear, distant 1.1 cable from shore. Here the *Windward* wintered, "Elmwood," our hut, being 400 yards distant.
- 12th. 10 P.M. Bay-ice forming rapidly.
- 19th. MDN. Furious gusts of wind every now and again.
- 20th. 2 A.M. Ship broke away from moorings. Got up steam, and by full speed managed to make her fast by 4 A.M., when gale decreased in force.
- 22nd. 2 to 6 P.M. Wind all round compass; very strong gusts from hills at times.
- 25th. NOON. Very fine snow falling thickly, like fluffy down, crystals shaped.
- 26th. 10 to NOON. Fog-bow. Then very fine snow only visible in sunbeams.
- 29th. Lanes of water opened in floe to southward and westward in morning, closing towards evening.
4 P.M. Snow crystals shaped with various patterns between points.
- 30th. 2 A.M. Frost-rime, three to four inches in thickness, formed on spars and rigging.

OCTOBER, 1894.

- 4th. 10 A.M. Ice blown away to southward from 300 yards south of ship. Snow driving thickly throughout.

- 5th. 4 P.M. At sunset a long dusky red column of light was thrown above sun and in contact with it to altitude 15° ; another similar appearing 20° to southward of sun parallel to former one. A mile and a half from ship towards Miers.
- 18th. 2 P.M. Channel (north-westerly), found there was no wind whatever.
- 10 A.M. to 6 P.M. A dozen cir-c. clouds, solid appearance, like thick drifts of snow, with very rounded backs, dark coloured and tinged with red and pink, were visible in N.W. and W. portion of sky, with no apparent motion, altitude 40° . Meanwhile very long regular lines of cir-s. were stretched to and over one another for 15° above sun.
- 23rd. 6 A.M. Frost-smoke rising in great quantities from open water about half a mile from ship to S.W. Bay-ice forming rapidly.
- 28th. Wind steadier than usual throughout the day. Occasional fierce gusts throughout force 10 to 11.
- 29th. 10 A.M. to 2 P.M. Wind varying every few minutes between N.W. and S.E.
- MDN. Ice cracking loudly near shore.
- 30th. 6 P.M. Ice-pressure taking place under influence of southerly wind.
- 31st. MDN. Yesterday left seal-hook stuck in ice, with line attached to it, and made fast to harpoon, which was driven into a dead walrus afloat on open pool. This morning went for it; found that everything had been over-ridden and driven under by ice-pressure.

NOVEMBER, 1894.

- 3rd. Open water 300 yards of ship, extending to Mabel Island and up Miers Channel.
- 12th. 4 P.M. When out on floe 300 yards ship found it quite calm, but strong gusts blowing round stranded bergs every few minutes.
- 17th. Members of land party removed to the hut ashore.
- 20th. 10 A.M. Mist similar to Scotch mist.

- 21st. Snow driving fiercely during gale formed drifts 2 to 7 ft. in height.
- 24th. 2 P.M. Warm balmy wind.
8.10. Sharp shower of rain three minutes' duration.
8.20. Fine snow commenced falling.
- 27th. 4 P.M. Dark, well-defined water-sky over horizon from E. through S. to W.
- 28th. NOON. Red glow on horizon to southward.

DECEMBER, 1894.

- 6th. Snow driving thickly throughout.
- 7th. 6 P.M. Clouds passing quickly from N.W. ; calm below.
8. Large semi-circular halo over moon, radius 14° .
- 9th. MDN. Halo round moon, diameter 28° .
- 10th. 6 P.M. Clouds moving from W. to E., medium rate, wind E.N.E. 4
8. Clouds moving from W.S.W. to E.N.E. slowly, calm.
10. Clouds moving from N.W. to S.E. medium rate, wind E. 3.
- 12th. 4 P.M. Halo round moon, diameter 28° .
- 19th. Loud rustling and whistling sound of ice in motion could be heard to-day during the calm.
- 22nd. Snow crystals shaped similarly to those of September 29th.
- 28th. MDN. Ice cracking loudly on floe under influence of tide and pressure.

JANUARY, 1895.

- 6th. Large snow-drifts formed on S.W. side of house nearly to top.
- 8th. NOON. Orange-coloured glow over southern horizon.
- 9th. 8 P.M. Large halo round moon, diameter 44° .
- 14th. 2 A.M. High snow-drifts about house, especially to S.W. of it.
- 24th. 4 P.M. Ice making loud roaring noise.
- 27th. 2 P.M. Frost-smoke rising thickly at the bases of Bell and Mabel Islands.
- 29th. MDN. Air full of particles like fine powdery falling snow.

Stars shining brilliantly at same time all over the heavens.

- 31st. 2 P.M. Moon and Jupiter visible only ; light too strong for other celestial bodies to be seen with naked eye.
 8.30. Sky quickly became overcast. Just previously all celestial bodies brilliantly visible.
 10. Could see islands to westward distinctly outlined on horizon. Stratus clouds hanging thickly just over them.

FEBRUARY, 1895.

- 2nd. 2 A.M. Saw long stretch of open water to-day extending from opposite the centre of Mabel Island, round by Cape Flora, and away E. about two miles from the shore.
 6th. 6 P.M. Double halo round moon.
 8th.^a 8 P.M. Thick frost-smoke by Bell and Mabel Islands.
 10. Cirrus moving from N. to S. with great rapidity, wind N.W. 5.
 11th. NOON. Frost-smoke rising thickly at S.W. and N.W.
 15th. 10 P.M. About a mile out on floe to southward found large wide expanse of water where ice had opened out under influence of tide and current.
 17th. 8 P.M. When walking out on floe found that late gale had brought down great quantity of ice and pressed it up against our floes in huge hummocks.
 18th. Ice appeared quite changed to-day, when off our land floe. Saw it at work thus : Walking outside a huge mass of heaped-up ice which had been crushed up on the fast ice, could hear groans and creakings from it every now and again. Climbed over inside of it and saw a crack in the floe (which appeared to be 18 feet in thickness), and it gradually widened out, the whole enormous mass of hummocks being moved off by the tide. Watched it open out about 10 feet.
 19th. Could see frost-smoke rising a long way to southward and westward during A.M., and to S.E. and E. during P.M.
 21st. 6 A.M. Frost-smoke rising thickly to S.E., S., and S.W.
 27th. 4 P.M. Frost-smoke rising thickly to S.S.W. and W.

MARCH, 1895.

- 1st. 4 P.M. Snow driving in fine icy spiculæ.
- 3rd. 6. No water to be seen.
10. Double halo round moon. Inner halo yellow with border of brown-yellow. Outer halo dark green with border of red-brown. Inner diameter $1^{\circ} 36'$, outer $2^{\circ} 36'$.
- 5th. 4. Frost-smoke rising at southward.
- 6th. NOON. Parhelion, radius $22^{\circ} 0' 25''$, corrected altitude of sun's lower limb $4^{\circ} 22' 30''$.
- 8 P.M. Cirrus travelling rapidly across the heavens from eastward, calm below.
10. Paraselena, radius $22^{\circ} 31' 45''$.
- 7th. NOON. Parhelion and paraselena, as yesterday.
- 8th. Ascended to summit of Cape Flora. Ice to southward and westward very much broken up, there being numerous lanes of water.
- 9th. 8 A.M. Parhelion visible on sun rising, soon disappeared.
- 17th. 8 A.M. Parhelion.
- 19th. 8. Parhelion, air full of small icy particles.
- 21st. Snow driving thickly, could see it blown furiously in whirls at 20 to 100 yards distant over narrow space of ground, and blowing strongly down Miers channel continuously.
- 23rd. NOON. Long lines of cirro-stratus, arched from E. to W. points of horizon, all over heavens, having common N. foci in those points.
- Thickness of ice on this year's floe 4 ft. 8 in.
- 24th. 4 P.M. A long straight line of thin mist half way up Bell and Mabel islands, looking like cirro-stratus.
- 25th. NOON. Blowing in gusts, forces 1 to 8. When out on floe, in direction of Miers Channel, wind appeared to be blowing strongly from N.E. ; at house N. force 1.
- 26th. Could hear wind blowing furiously from N.W. during night.
- 27th. 8 A.M. Aneroid falling .05 during gusts and rising again as they died away ; mercurial barometer affected to smaller extent.

450 A THOUSAND DAYS IN THE ARCTIC

28th. 4 P.M. Saw what appeared to be open water about 11 miles to southward.

APRIL, 1895.

- 1st. 4 P.M. Snow driving hard formed high thick drifts about hut.
 2nd. Snow driving hard throughout, cannot say positively whether or no snow was falling.
 3rd. Snow driving thickly throughout.
 6 P.M. Ice broke up to alongside the ship; intact inshore.
 8. Ice drifted away to S.W.
 4th. 8 A.M. Frost-smoke rising thickly from open water.
 NOON. Bay-ice forming quickly outside ship.
 6th. 8 A.M. Clouds moving rapidly from S.W., calm below. Very thin powdery snow falling hardly perceptible.
 6th. 4 P.M. Open pool and lanes of water a quarter mile from land.
 7th. NOON. Frost-smoke rising thickly.
 8th. NOON. Parhelion. Frost-smoke.
 9th. 6 P.M. Parhelion.
 8. Long wavy arched cirrus clouds running over one another.
 10th. NOON. Pools of water all round, 300 yards from shore, with frost-smoke rising from them.
 12th. Parhelion all day, very faintly defined.
 13th. 8 A.M. Parhelion. Air full of small icy particles.
 NOON. Frost-smoke rising very thickly.
 18th. 8 P.M. Small glistening particles falling.
 20th. 10 P.M. Semi-parhelion over Mabel Island.
 21st. 10.30 P.M. Semi-parhelion over Mabel Island.
 25th. NOON. Bay-ice from a mile from coast to horizon; some lanes of water in it.
 8 P.M. Clouds passing over from W. to E., wind N. to W. 3.
 26th. NOON. High cirrus passing from N.W. to S.E. all days; wind N.N.W. 4.
 27th. 8 A.M. Cirro-stratus passing quickly over zenith from S. to N.; wind E. 1.
 MDN. Calm; cirrus passing from W. to E. over zenith.

MAY, 1895.

- 2nd. 4 P.M. Cirro-stratus passing rapidly from N.W. to S.E. ;
wind N.W. Small pools of water at S.W. distant 3
miles.
- 3rd. NOON. Open water 2 miles out. Narrow lanes 4 miles
long.
7 P.M. Much water for about ten miles from E. to W.
- 4th. 8 A.M. Sheet of open water 10 miles long.
- 5th. 8 A.M. Open water from Cape Grant to 4 miles south of
Cape Gertrude on southern horizon.
8.30. Parhelion.
- 6th. 8 A.M. Ice visible beyond open water at S., extending for
about two miles to horizon.
- 7th. 8 A.M. Water extending to horizon from about a mile from
beach.
- 8th. 8 A.M. Water at S. and W. as far as visible.
8 P.M. Ice visible on horizon except at W.
10. Bay-ice formed on open water.
- 9th. NOON. Very little water visible, thin bay-ice having nearly
entirely covered it.
- 12th. NOON. Narrow lanes of water.
- 13th. 8 A.M. Large expanse of water at S.
- 14th. 8 A.M. Large expanse of water at S.E. and W. nearly to
horizon.
- 15th. Open water as yesterday.
- 16th. 10 A.M. Water southward and westward as far as can be
seen, commencing about three-quarter mile beyond ship.
8 P.M. Ice making great noise, coming in from S.E.
- 18th. 8 A.M. Scarcely any ice visible southward and westward.
4 P.M. Large pieces of ice peeling off from floe.
- 19th. 8 A.M. Large expanse of water to southward and westward.
- 22nd. NOON. Quantity of water to southward and westward about
twelve miles distant.
- 23rd. NOON. Open water as far as can be seen from 150 of
elevation to southward and westward.
4 P.M. Large pieces of ice peeling off land-floe.
- 24th. 4 A.M. Cirrus moving from S.E. to N.W.; wind N.N.W. 5.

8 P.M. Cirrus moving from W. and S.E., taking circular motion as cloud meets cloud.

25th. NOON. Except land-floe, no ice visible from 570 ft. elevation to S.E., S.W. and W.

30th. A.M. A quantity of young and brush ice up against floe and to southward.

JUNE, 1895.

1st. 8 P.M. A quantity of young ice cleared away to westward.

2nd. 8 A.M. Ice brought in again by southerly wind.

3rd. 6.30 A.M. A heavy shower of rain.

7th. NOON. Very fine snow falling.

13th. NOON. Ice blown out by northerly wind.

14th. NOON. Large expanse of open water.

15th. 4 P.M. Ice peeling off land-floe.

22nd. 8 P.M. Some ice driven off floe at eastward and westward.

26th. 8 A.M. Ice peeling off land-floe.

29th. NOON. Ice gradually peeling off land-floe.

JULY, 1895.

1st. 8 P.M. Southerly swell.

2nd. 8 P.M. Ice broken up to outside of ship by swell.

3rd. 3 A.M. Ship departed. Clear open water to horizon.

7th. 8 P.M. Long arched lines of cirro-stratus under sun.

10th. 5 P.M. Thick mist spread over from S.W.; could very plainly see specks of mist falling; continuous fog-bow.

10 P.M. Parhelion.

15th. 4 P.M. Short showers of snow at frequent intervals.

16th. 4 A.M. Sharp showers of mingled snow and hail; 15 minutes.

23rd. NOON. Ice visible at E.

8 P.M. Ice moving from E. towards S.

26th. NOON. Ice visible at S.

4 P.M. Heavy swell from S.W.

27th. 8 A.M. Large quantities of loose ice at E., S, and S.W.

30th. 8 A.M. Drift ice in all directions.

31st. NOON. Heavy swell.

AUGUST, 1895.

- 1st. NOON. Heavy southerly swell.
3rd. 8 P.M. Drift ice from eastward.
7th. 8 A.M. Drift ice at west.
13th. NOON. Large quantity of ice coming in from eastward.
14th. 8 A.M. Large quantities of ice visible to southward and westward: clearer near Cape Flora.
15th. 8 A.M. Quantities of drift-ice about, but clearing away.
16th. NOON. Drift-ice all round the cape.
17th. NOON. Ice as far as can be seen from an elevation of 500 ft.
19th. 8 A.M. Ice clearing away from land slightly.
4 P.M. Sea almost clear of ice to westward.
8. Clouds moving rapidly from S.W.; wind N.N.W. 2.
24th. NOON. Wind flying round compass in gusts, force 5 to 6.
30th. NOON. Ice blown from shore about three miles by wind.

SEPTEMBER, 1895.

- 3rd. 4 P.M. Occasional falls of snow.
9th. 8 A.M. Quantities of loose ice covering the water.
14th. NOON. Bag-ice forming.
15th. 4 P.M. Ice closely packed inshore.
16th. 4 P.M. Ice driven out $1\frac{1}{2}$ miles.
21st. 8 A.M. Ice out about six miles.

OCTOBER, 1895.

- 2nd. 4.45 P.M. A red shaft of light upwards from sun extending to altitude 15° .
5th. 4 P.M. Long arched lines of cirro-stratus over sun.
7th. 8 A.M. Bay-ice broken up by winds.
15th. 11.20 A.M. \odot $1^{\circ} 43'$ h. e. 50 ft. Brilliant shaft of light thrown up by sun to altitude $21^{\circ} 58' 10''$ from sun, prismatic colouring.
22nd. 4 P.M. Apparently open water on horizon between E.S.E. and W.S.W. about fifteen miles distant; heavy water-sky.

- 24th. 8 P.M. Heavy water-sky at S.
 26th. 8 A.M. Heavy water-sky over horizon from S.E. to W.S.W.
 8 P.M. Very fine snow falling.

NOVEMBER, 1895.

- 2nd. 10 P.M. Large paraselena; snow driving.
 6th. Snow driving very hard and thickly throughout.
 9th. 4 A.M. Paraselena.
 NOON. Clouds moving rapidly from westward; calm below.
 12th. NOON. Sun-glow at S. and S. and S.E.
 13th. 10 A.M. Cirro-stratus arched over horizon at S.
 2 P.M. Arch of cirro-stratus across whole heavens from W.N.W. to E.S.E., meeting in common force.
 15th. 4 A.M. Lane of water about a mile out on floe, from S.E. to W.S.W.
 16th. 6 A.M. Lanes of water one-half to three-fourth mile out on floe and a little way up entrance to Miers Channel.
 NOON. Terracotta-red glow at S., sapphire-blue sky.
 26th. 4 A.M. Large expanse of open water at S.S.W. extending to W.S.W.
 4 P.M. Gusts from between W.N.W. and N.N.W., force 6 to 10 every two or three minutes, calm in intervals. These gusts blow sometimes over the house while it is calm in other places, and *vice versa*.
 28th. 8 P.M. Halo round moon.

DECEMBER, 1895.

- 1st. MDN. Cirrus moving rapidly from S.; wind E. 1.
 12th. NOON. Red glow on southern horizon.
 13th. 4 A.M. Air filled with small falling particles of mist.
 4 P.M. Air filled with small falling icy spicules.
 14th. 8. Very black water-sky from S.E. to W.S.W.
 15th. 2 A.M. Large expanse of water to southward since heavy gale on 9th.
 2 P.M. Query very fine snow or thick particles of mist falling.

- 18th. 8 A.M. Light of dawn at S.E.
NOON. Rose-coloured light at S.
- 19th. NOON. Glow of dawn on southern horizon.
- 28th. 4 P.M. Small chrome-coloured halo round moon.
- 29th. 4. Very large halo round moon.
- 30th. 4 A.M. Frost-smoke rising from open water.
- 31st. 4 P.M. Large halo round moon.
8 P.M. Thick frost-smoke rising from water at S.E. through S. to W.

JANUARY, 1896.

- 1st. 6 P.M. Large halo round moon.
- 17th. 10 A.M. Stratus over southern horizon believed to be due to large quantities of frost-smoke rising from considerable area of open water.
- 18th, 19th, 20th. Very fine snow.
- 20th. 6 P.M. Air full of small falling powdery particles.
- 21st. 6 A.M. Air full of small particles.
8. Wide expanse of water to southward.
4 P.M. Large faint halo round moon.
- 25th. 2. Frost-smoke rising thickly from large expanse of water, visible to southward, eastward, and westward.
- 28th. 10 A.M. A large expanse of open water extending to horizon at S., and E. and W. of it, half to three-quarters of a mile from shore. Bay-ice forming rapidly.
NOON. Bright orange glow at S.
- 29th. NOON. Bright orange glow. Light eclipsing stars under third magnitude.
4 P.M. Loud noise of ice-pressure.
MDN. Everything covered with frost-rime.
- 31st. 4 A.M. Frost-rime on everything.
8. Brilliant dawn at S.E.

FEBRUARY, 1896.

- 1st. 10 A.M. Ice-blink at S.E. and S.; heavy water-sky as S.W. and W.
- 3rd. 6. Could hear wind blowing through gullies at top of Cape Flora rocks; calm below.

NOON. Ice as far as can be seen ; a crack open three-quarters of a mile distant.

2 P.M. Very clear on southern horizon for 2° above it between S.E. and S.W.

MDN. A long lane of water opened E. and W. at the edge of the land-floe.

4th. 10 A.M. Long, open, wide space of water at S.W.

6th. 6 A.M. Frost-smoke from large lane of open water at S.W. and W.

7th. NOON. Large expanse of water at S. extending E. and W.; frost-smoke rising thickly.

8th. NOON. Frost-smoke rising thickly at W.N.W. obscuring Bell Island. Big ice on horizon. Bay-ice and open lanes between it and land-floe.

11th. 10 A.M. Semi-arch of light at S.E. blue sky; clouds moving rapidly from S., wind E. by S., 3.

NOON. Fan-shaped rose-tinted shaft of light thrown to 20° above horizon at S.

13th. 8 P.M. Long lane of water S., extending E. and W., formed by ice opening out from land-floe, caused by wind and tide.

14th. 2 P.M. Cirro-stratus arched in long lines over the sun.

10 A.M. Air full of icy particles

17th. 2 P.M. Stratus all round horizon like fog-bank.

19th. 6 A.M. Open water visible on S.W. horizon.; frost-smoke rising quickly from it.

20th. NOON. Open water at S. and W., frost-smoke rising from it.

21st. 4. A.M. Loud rushing sound of wind blowing among cliffs on top of Cape Flora.

22nd. 4 P.M. Ice-blink round horizon.

23rd. NOON. Mist on horizon, caused by frost-smoke from open water, ice being carried out. Very high upper clouds.

24th. 8 A.M. Large expanse of open water at S., extending E. and W.

8 P.M. Clouds driving across moon from W.S.W. to E.N.E.; S.W. 5.

25th. 8 A.M. Very thick mist 400 feet up talus, slight mist lower down.

- 26th. 8 P.M. Rushing sound among rocks at top of Cape Flora, apparently strong wind blowing there.
- 27th. 8 A.M. Large open lane of water at S. and to E. and W. of it; frost-smoke rising from it.
- 28th. 8 P.M. Large expanse of open water at S. and E. and W. from it.
- 29th. 8 A.M. Open water being covered with bay-ice.

MARCH, 1896.

- 1st. NOON. Frost-smoke rising from open water one mile distant.
- 4th. 4 P.M. Cirrus moving from S.W.; wind W.N.W. 1.
- 6th. Star-shaped snow-flakes.
- 18th. 8 A.M. Air full of icy particles.
- 19th. 4 P.M. Open water at S. and S.E. three miles distant.
- 20th. Snow driving throughout.
- 21st. NOON. Parhelion.
4 P.M. Some lanes of open water at S.W. distant one mile.
- 22nd. 8 A.M. Parhelion.
- 23rd. NOON. Parhelion.
8 P.M. Halo round moon.
- 26th. 8 P.M. Brilliant orange-coloured sunset.
- 27th. 8 P.M. Cirro-stratus moving from S.W., calm below.
- 30th. 8 P.M. Rushing noise among rocks at summit of Cape Flora.

APRIL, 1896.

- 8th. NOON. Snow driving hard throughout.
- 11th. 8 P.M. Frost-rime forming thickly.
- 14th. 8 A.M. Ice driven out by wind.
8 P.M. Clouds passing over from S.W.; wind E.
- 16th. 4 P.M. Long wavy interlaced lines of cirrus.
- 19th. NOON. Very numerous cirrus clouds moving rapidly from E.S.E.; wind E. 3.
- 24th. Parhelion all day.
- 29th. 1.30 A.M. Clouding over from south-westward; wind N.W. 1.

MAY, 1896.

- 8th. 4 P.M. Parhelion.
- 9th. NOON. Heavy water-sky at S.E., S., and S.W.
4 P.M. Open water to southward.
- 11th. 8 A.M. Parhelion.
- 16th. 8 A.M. Very black water-sky at S.E., S., and S.W.
- 19th. 8 A.M. Large expanse of open water at S.
- 22nd. 4 P.M. Very fine falling snow shaped ' ; some hard, round
(size ●), like hail.
- 25th. 12.30 A.M. Commenced raining.
- 30th. NOON. Ice being blown off by wind, open water, and very
heavy water at southward.
- 31st. 8 A.M. Large expanse of water at S.E., S., and S.W.
NOON. Much refraction.

JUNE, 1896.

- 1st. 4 P.M. Very heavy water-sky to southward.
- 5th. 8 A.M. Large expanse of water at S.S.W. and W. Clouds
passing rapidly from N. ; wind S.E. 6.
- 7th. NOON. Large extent of water at S.
4 P.M. Ice peeling off land-floe.
- 8th. Very wet falling snow throughout.
- 13th. 8 P.M. Cirro-stratus arched under sun, over horizon.
- 20th. 4 P.M. Thick mist hanging over top of land.
8. Hard, unevenly-shaped icy flakes.
10. Raining heavily, and during greater part of night.
- 21st. 4 P.M. Mist hanging over tops of islands.
8 P.M. Clear below 300 feet, mist above.
- 22nd. 8 P.M. Mist commenced at 100 feet elevation.
- 23rd. NOON. Very fine rain, like Scotch mist, till 8 P.M.

JULY, 1896.

- 14th. 8 A.M. Mist hanging very thickly over top of land.
- 21st. NOON. Clouds driving from northward ; wind variable from
eastward.
- 25th. 4 P.M. Mist hanging thickly over top of land.

AUGUST, 1896.

- 7th. 4 P.M. Very fine snow.
26th. NOON. Mirage of ice at S.
8 P.M. Cirro-cumulus moving rapidly from S.W.; wind
E.S.E. 1.
30th. NOON. Snow like half-formed hail.
31st 8 P.M. Cirro-cumulus moving slowly from N.E.; wind
N.N.W. 5.

SEPTEMBER, 1896.

- 16th. 4 P.M. Summit of Cape Flora just capped with cloud.
18th. 8 A.M. Thick low fog; fine and clear overhead; fog-bow.
19th. 8 P.M. Low thick fog-bank coming down Miers Channel at
W., and by Cape Gertrude at E.: islands just visible
above it.
20th. NOON. Very wet mist.
23rd. NOON. Clouds in layers along the land.
25th. 8 P.M. Very fine rain. At 9.30 snow falling thickly.
26th. NOON. Drizzling since last observation. Glazed frost.
8 P.M. Clouds nearly to sea level.
27th. 8 A.M. Thick bank of fog at E. across lower part of land;
same at W., rising to 600 feet.

OCTOBER, 1896.

- 4th. NOON. Mist hanging thickly over top of land.
5th. 8 A.M. Clouds moving rapidly from N.E.; wind N.W. 1.

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THE situation of the Observatory was not altogether favourable for observing aurora. High ground hid the horizon from N.E. to N.W. to an altitude of 1300 feet. The highest point is 1400 feet, and its horizontal distance from the Observatory was about 1200 feet. The bearings given are true, not magnetic.

SEPTEMBER, 1894.

- 23rd. MDN. Faint aurora, long streamers across zenith.
- 24th. MDN. Aurora for 15 minutes, pale green, W.S.W. to S.S.E., and in zenith; disappeared to eastward.
- 25th. 11.40 A.M. to 5 P.M. Clear overhead. Observed aurora, altitude 60° ; long narrow bands S.S.E. moving S. to N. and disappearing.
- 30th. MDN. Aurora, pale green, S.W. to E.; altitude of arch 70° , streamers radiating from it.

OCTOBER, 1894.

- 8th. MDN. Aurora, pale green, S.E. to N.W. across zenith: altitude 30° at extremes, broad band.
- 10th. MDN. Arched aurora N.W. and W., long streamers to N.E., pale yellow-green tint, like rays thrown from under cloud by sun.
- 11th. MDN. Aurora E.N.E. to W.S.W.; large arch 10° altitude in E.N.E., 50° in centre, 20° in W.S.W. extreme.
- 14th. 8 P.M. Aurora, pale green, W. to E., 10° above west horizon across zenith, 50° above east horizon in arch, several streamers from it; another small arch at W. extreme of larger one.
- 15th. 8 P.M. Aurora, pale green, narrow band across zenith E. to

- W., 70° altitude at each extreme; three streamers in N.W. just over horizon to 15° .
- 18th. MDN. Aurora chiefly N.W. to E., pale green, moving towards S.E.; arches and streamers appearing and disappearing like rolling of scroll.
- 19th. MDN. Slight aurora, pale green, S.W., altitude 30° ; streamer to S.S.E., altitude 60° .
- 21st. 5.30 P.M. Two long streamers (or bands) close together and parallel, E. to W. across zenith; west extreme 40° altitude, east 10° , pale green.
- 22nd. 5.30 P.M. Three large streamers (or bands) E. to W. across zenith; 15° altitude at east, 30° at west.
- 24th. MDN. Aurora E. to W. across zenith; altitude at extremes 15° from horizon; streamers from N. and N.W., main band or streamer moving to N.W., pale green.
- 25th. MDN. Slight aurora, four short streamers 15° apart round Ursa Major and Minor.
- 27th. MDN. Aurora, pale green, streamers on western horizon, extending to altitude 70° .
- 29th. 6 P.M. Brilliant aurora, pale but vivid green, large band E. to W.
- 6.45. Thick, cloud-like form of aurora, covering and concealing Ursa Major, sent out long streamers to N. and N.W., moved rapidly W.
8. Aurora moving rapidly from E. to W. and N. to S.; many arches and streamers entirely covering the sky.

NOVEMBER, 1894.

- 2nd. 7.30 P.M. Pale green aurora, band extending from E.N.E., altitude 10° to 30° ; another band commencing at nearly the end of above and underneath it extending to W. altitude 20° . First band had numerous streamers from it.
- 3rd. 12.20 A.M. A long band of aurora, altitude 10° , S.S.E. to S.W. Two streamers appearing like shafts of light from cloud in N.W., moving W.

- 5 P.M. Auroral bands pale green, E.N.E. to W.S.W.; streamers in N.W.
MDN. Aurora N. to W.
- 4th. MDN. Several small auroral streamers, pale green, E.S.E. to W.S.W., altitude 10° in E.S.E., 70° in S., 2° in W.S.W.
- 8th. 5.30 P.M. Aurora four, bands E. to W. and N.W.; thick cream-like colour; outer bands 30° to 70° altitude, E. extreme 10° , W. extreme 20° .
8.30 P.M. Aurora N. and N.W.; arch and streamers pale green.
MDN. Aurora E. through S. to W.S.W., pale green.
- 9th. 9 P.M. Aurora, bands of pale green over nearly the whole heavens, especially in N.W. Many streamers. One part of aurora in N.W. expanding and contracting and shooting about like flames darting upwards, finally disappearing rapidly to southward.
- 10th. MDN. Few small pale green streamers of aurora in N.W. varying from 10° to 60° altitude.
- 11th. 7 A.M. Aurora commenced in streamers at E. horizon, rapidly spread across zenith towards W., scintillating and shooting like flame, till it reached W. horizon; then formed into long thick bands, pale green; again separating into three bands which sent out numerous streamers and moved rapidly as before; finally breaking up and moving to northward.
- 13th. 1 P.M. Faint aurora, pale green, broad band E. to W.
4 P.M. Similar aurora at N.W. quickly disappeared.
- 14th. 6 to 7 P.M. Similar aurora to that of 11th; and from 9.20 to 9.40.
- 18th. 6 P.M. Brilliant aurora, similar in most respects to those of 11th and 14th; not quite so much colour, but larger N.E. to S.W.; moved in circle round heavens against watch at altitude 70° ; quite disappeared twice and reappeared in same place and shape. This aurora differed from those of 11th and 14th in having a double corona, one shooting out towards N.W., the other to S.E., with streamers at right angles.

- 19th. NOON. Aurora: streamers rising at E. gradually forming into long band E. to W. at altitude 70° , dividing into four bands and into numerous and varied spiral shapes, chiefly in S.E., later it became overcast.
- 30th. 4 P.M. Two auroral streamers at N.W.
- 7.15. Auroral band from E. over zenith to W.
- 8.3. Similar aurora, like the former moving rapidly to E.

DECEMBER, 1894.

- 1st. 10 A.M. A few auroral streamers N.E. to W.
- 2nd. NOON. Three auroral streamers extending to altitude 30° in N.W.; red glow to southward.
- 5th. 10.5 P.M. Brilliant aurora commenced in long streamers from E. through S. to W., coming to apex 10° below Polaris at 10.15. Long ridge of thicker light 5° above horizon, the whole spread out like a fan; some parts of base thicker than others and separated in circles.
- 10.25. Fringe of streamers changed from pale green to rose, brick-red, and bright green, and commenced moving rapidly and laterally to eastward with shimmering appearance. As one layer disappeared another opened out in numerous streamers, like a fan, and moving as previous ones.
- 7th. 10.15 P.M. Pale green band of auroral light shot rapidly across heavens from E. over zenith to W.
- 9th. 8 P.M. Four auroral streamers at E.
- 19th. Aurora all day in bands and streamers, chiefly E. to W.; culminating at 8 P.M. in brilliant display E. to W., being of spiral, fan-like, and circular shapes. Thick circular masses in W. extreme sending out streamers with rapid lateral motion to N. (having fringe of prismatic colours), which again closed up into bands and moved laterally and rapidly to the southward and disappeared, appearing to rise as it did so.
- 28th. 2 P.M. Auroral streamers in N. and N.W. with fringe of varied colours, altitude 30° . Bands across heavens from E. to W., moving laterally from N. to S. at frequent intervals during afternoon.

- 29th. Aurora throughout most part of the day. Bands E. through S. to W., chiefly 10° to 50° altitude.
- 30th. 8 A.M. A few streamers extending to 20° altitude at N.W.
- 1st. 2 A.M. Auroral band across zenith E.S.E. to W.S.W.
4. Similar aurora.
- 4 P.M. Auroral band across zenith E. to N.W., with streamers at N.W. and W.
6. Three auroral bands across heavens E. to W.; large cloud-like patch in zenith.
8. Three auroral bands across heavens E. to W., altitude 20° to 50° .
10. One auroral band across heavens E. to W., altitude 10° , streamers at intervals shooting up perpendicularly.
- MDN. Two auroral bands from E.N.E., altitude 30° to W. meeting horizon.

JANUARY, 1895.

- 1st. 2 A.M. Streamers extending all over heavens.
- 6 P.M. One small streamer at N.W.
10. Streamers E. to S.W., altitude 10° to 70° .
- MDN. Corona in zenith with streamers shooting out all round heavens, having rapid circular and lateral motion.
- 5th. 5.30 P.M. While making observations for inclination with Dip Circle, the needle was much disturbed for five minutes.
- 6th. 8 P.M. Large auroral corona in zenith with numerous streamers from it all round heavens. At 8.10 streamers closed with lateral movement to eastward, and collected in single broad thick band of sinuous shape E. to W.
- 7th. 2 A.M. Auroral band across zenith E. to W.
8. A few isolated streamers at N. and N.W.
- 9th. 6 P.M. Aurora at N.W., circular shape with streamers.
- 15th. 10. Aurora gathered in bands and circular pale green masses between E and S.W. at altitude 20° ; sent streamers up rapidly to zenith, which formed at 10.10 brilliant corona, which together with streamers circled

round heavens gradually (apparently) disappearing in space, leaving a faint white light of their shape, which was visible for half an hour. One circular mass moved round heavens to W. and N. and sent out streamers with lateral movement which darted about in all directions and finally disappeared as the others had done. The colouring of this display was brilliant rose and green.

16th. 6 P.M. Aurora in detached cloud-like masses, altitude 5° to 30° , with a few very short streamers rising upward from them. At 8° similar.

MDN. Brilliant corona in zenith with streamers radiating from it all round heavens to horizon, rose and green colouring.

17th. 4 A.M. Four bands of auroral light across heavens from N.N.E. to S.S.W.

8. A few streamers at N. and N.W.

2 P.M. Serpentine auroral band from E. through zenith to W.

4. Band from E. to S.W., altitude 10° .

8. Similar band. Almost constantly throughout the day there have been bands and streamers from E. through S., S.W. and N.

MDN. Fine auroral display. Corona in zenith, streamers shooting out in all directions and moving rapidly with circular and lateral motion.

18th. 8 A.M. Streamers at E. and S.W., altitude 50° to 70° .

NOON. Indistinct corona in zenith with streamers radiating from it all round heavens, apparently very distant, could only see part of it.

4 P.M. Auroral band from E. through zenith to W., with a number of brilliant fan-shaped streamers having fringes coloured rose and green.

6. Streamer at N.W. and W.; band from E. through S. to W.

8. Bands from E. through S. to W., altitude 5° to 20° .

MDN. Streamers at E., E.N.E., and W.S.W.

19th. 2 A.M. A few streamers on western horizon.

4. Two small streamers at zenith.
 6. Irregular band or arch across zenith N.E. to S.W.
 8. Corona with streamers radiating from it all round heavens.
- NOON. Two small streamers in N.W.
- 2 P.M. Sinuous band E. to W. At 4 P.M. similar.
8. Band from E. through S. to W., altitude 5° to 15° .
 - 9.15. Corona in zenith, streamers round heavens scintillating and moving round, disappearing at 9.25.
 10. Band and streamers in N. and N.W.
- MDN. Band of auroral light at E., altitude 6° .
- 20th. 2 A.M. Band from E.N.E. through zenith to W.S.W.
4. Corona in zenith, with streamers all round heavens, especially towards S. and E.
 - 4 P.M. Brilliant pale green thick band E. and W.
 6. Five bands across heavens E. through zenith to W., joining at common point each extreme.
 8. Two bands from E. through S. to W., altitude 10° .
- MDN. A few cumulus-like auroral patches in E., W., and S.W.
- 21st. 2 A.M. Band of auroral light at E. ; at 4 A.M. in S.E. also.
8. Corona in zenith, streamers from it to between W. through N. and E.
 - 4 P.M. Arched band from E. through S. to W., altitude at centre 30° .
 6. Arched band from E. through N. to W., altitude at centre 40° .
 8. Faintly defined, but numerous over the whole heavens, chiefly trending from an E. to W. direction.
 10. Band from E. through S. to W.S.W.
- 23rd. 10 P.M. A few cloud-like and serpentine-shaped auroral patches and bands in zenith, and from W. to S.W., moving bodily to eastward.
- 25th. 8 P.M. Cloud-like streaks and patches of auroral light in S.E., S. and S.W., altitude 10 to 30° .
10. Auroral patches in S.W., N.W. and N.
- 29th. 10 P.M. Auroral bands indistinctly visible amidst clouds in zenith from E. to W.

- 30th. 4 A.M. Brilliant streamers, altitude 80° , extending to horizon, pale yellow-green, from N.E. through N.W. to S.W.
8 P.M. Cloud-like auroral patches from E. to W. with streamers from them at altitude 30° .

FEBRUARY, 1895.

- 1st. 8 P.M. Auroral bands through S. to S.W. with fringes, altitude 10 to 40° .
MDN. Faint patches of auroral light at E.
- 2nd. 2 A.M. Band at zenith, disappearing behind clouds.
4. Auroral light on edges of clouds to southward.
6. Faint auroral band across zenith.
6 P.M. Band and streamers from E. through S. to W., altitude 10 to 40° .
8. Similar aurora.
- 3rd. 2 A.M. Arched band from E.N.E. to W.S.W., altitude 10° in centre, slight patch of auroral light at S.E.
8. Three faint streamers in zenith extending to W., 45° above horizon. No clouds visible except two lines of perfectly straight cirro-stratus, which could only be seen when the red glow from the sun spread to S.E., S. and S.W., altitude of upper line of cloud 2° .
10 A.M. More layers of cirro-stratus visible as sun's light spread higher above the horizon. At 10.5 straw-coloured streamers, fan-shaped, rising from band E. through S. to S.W., altitude 15° to altitude 30 and 40° . At 10.15 streamers collected in group, with circular motion and gathered into circular masses.
2 P.M. Similar straight line to those of the 3rd.
4. A few straight lines of cirro-stratus at westward, visible in orange-coloured light.
- 5th. 6.20 P.M. Brilliant auroral display, commenced by rising in E.N.E. moving slowly through S. to W., pale yellowish-green colour. It shot across heavens at altitude 80° to N.E. in about five seconds, colouring rose, green and yellow, recurving in another band through N. across to W., altitude 60° , then lost the prismatic colouring and

became straw-colour or yellowish green. At 6.34 P.M. band from N.E. to W. moved, like shooting flame, laterally and with great rapidity, without losing its formation in shape, which was like a deep figure. At the same time the band formed into numbers of circular bands. At 6.37 P.M. band N.E. to W., appeared to rise up in space and move bodily to zenith in southerly direction, growing much fainter at same time and losing nearly all colour, becoming like drifting white smoke.

- 5th. 10 P.M. Auroral semi-corona in zenith with streamers radiating from it to N.E. through E. and S. to W. A few patches at E., altitude 40° .
- 10th. 8 P.M. Auroral arches from E.N.E. to W.S.W. in northern part of heavens, varying in altitude up to 60° , arched toward zenith.
- 10. Corona in zenith, streamers radiating from it round heavens. Bands low down from S.E. through S. to S.W.
- 11.15 P.M. Observed aurora exactly in the zenith: rapidly moving tongues of tricoloured light, yellow, to emerald green, thence to orange and rose, in the order named, the last colour formed being rose of two shades. Gradations of all these tints were visible though movement was very rapid.
- 11th. 6 P.M. Auroral bands from E. over N. and through S. to W., with streamers and scintillating fringes.
- 12th. 10 P.M. Streamers at E.
MDN. Broad faint band from W. to zenith.
- 13th. 8 P.M. Brilliant auroral display. Coronas continually forming by streamers shooting up from S.E. then moving to N. and N.E. Streamers and serpentine bands shooting and radiating in all directions.
MDN. Thick auroral band from E. through S. to W.S.W., altitude in centre 15° . Streamers from it forming apex at 90° , having lateral scintillating movement.
- 14th. 2 A.M. Faint auroral patches at E. and N.E.
- 4. Streamers crossing zenith from N.E. to S.W.
- 6.30 P.M. Three wavy bands across heavens from E. through

zenith to W.:—E. through S. (altitude 70°) to W.S.W.:
—and E. through N. (altitude 70°) to N.W.; also a band
from S. to N.E., altitude 10° ; and a few streamers at E.
rising to altitude 20° .

8 P.M. A band from E. to S.W., altitude 10° .

10. A band from E. through S. to W., altitude 10° .

15th. 6 P.M. Arched bands from E. through N. to N.W., altitude
 10° . Thick forked wavy band across heavens from E.
through N. and N.W., meeting the first at its extreme.
Two bands from E. through S. to W., altitude 15° . At
6.15, band across zenith moved laterally to S.W.

8. Large circular fringe of streamers at S.E., altitude 30° ,
with band to S.W., altitude 10° .

10. Two bands with short streamers from E. through S. to
S.W., altitude 0 to 30° .

16th. 2 A.M. Faint patches of auroral light at E., altitude 40° .

4. Patches of auroral light from N.E. to S.W. and in E. and
S.E.

8 P.M. Auroral streamers at S.E., altitude 70° .

17th. 8 P.M. A few cloud-like patches of auroral light to S.E., S.
and S.W.

10. Thick wavy band from E.S.E. to W., moving laterally
to S., altitude 70° ; streamers at E. 50° .

MDN. Arch from E. through S. to S.S.W., altitude at centre
 30° .

18th. 8 P.M. Faint wide band from E. to W. across zenith, broken
up in places like streamers.

10. Cloud-like patches at S.E., S. and S.W.

MDN. Band over horizon from E. to S.

19th. 2. A.M. Disconnected band from W.S.W., altitude 5° , to
zenith.

4. Bands and streamers from W. to zenith, patches in S.E.
and E.

8 P.M. Irregular arch from N. to W.N.W., altitude 60° .

10. Disconnected band from E. to N.W. across zenith,
streamers at W., altitude 50° .

MDN. Band from N.E. to S.E.

20th. 2 A.M. Irregular auroral band across zenith from E. to W.

4. Irregular band from S.W. to N.E., and band across sky at S.E. and E., about altitude 25° .
- 8 P.M. Brilliant aurora: circular base, altitude 15° , with streamers shooting up to common focus bearing S., altitude 70° . Band running from base through S. to W. Streamers from it making for common focus formed corona in zenith which broke up at 8.15 into numerous serpentine bands and arches all over heavens, their general direction being E.S.E. to W. and gradually faded away.
10. Disconnected band from E. to S.W., altitude 10° ; short streamers rising up from it to altitude 30° .
- 21st. 8 P.M. Auroral band from E. to S., altitude 5 to 15° .
MDN. Bands and streamers in zenith, E., W. and N.W.
- 23rd. 10 P.M. Band, altitude 20° , partially obscured by clouds, at S. and S.W.
- 24th. 4 A.M. Streamers from N.E. to zenith. At 6, faint band at E.
8 P.M. Thick, arched fringe, E. to W., 20° altitude in centre. Faint streamers shooting up from it and forming apex in zenith.
10. Semi-corona in zenith; streamers radiating from it down to horizon all round heaven, with the exception of between N.N.W. and E.N.E.
- 25th. 2 A.M. Broad, faint band from S.S.W. to zenith. Narrow, faint band from N.N.W. to zenith.
- 10 P.M. Thick fringe from E. to S.W., altitude 10° , scintillating, and moving laterally to and fro. Sent up streamers to zenith, forming apex. Streamers seemed formed in layers, the fringed base forming into thick, circular masses. Whilst on the floe between 9 and 10 P.M. (the night being exceptionally dark) noticed a distinct light, cast on the ice by the aurora.
- MDN. Streamers from N. to S.E., altitude 70° to zenith.
- 27th. 10 A.M. Long arches of cirro-stratus from E. to S.W., meeting at horizon in each extreme.
- 2 P.M. Altitude at centre 10° ; coloured dull grey stone; fleecy-white, and reddish-tints; the lines becoming much thinner as the altitude increased.

- 10 P.M. Short, arched, close fringe of streamers at altitude of 15° from E.S.E. to S.W.
- 28th. 2 A.M. Similar aurora to that of 27th, at 10 P.M. from E.N.E., through S. to W., altitude 20° . Band across zenith from S.W. to N.E.
- 8 P.M. Wavy, arched band from E.S.E. to W., altitude at centre 20° ; streamers from it forming apex in zenith. Streamers in uneven layers.
10. Corona in zenith. Short streamers from it radiating round heavens.

MARCH, 1895.

- 2nd. 8 P.M. Auroral streamers, altitude 60° to zenith, at S., band; altitude 20° S.E. through S. to W.
- 3rd. 10 P.M. Irregular arch from E. to W.S.W., altitude 20° . Streamers from circular cloud-like patch, altitude 15 to 30° , at E.
- 14th. 12.30 A.M. Corona at zenith with range to all points of the horizon from which streamers met them.
- 15th. 11 P.M. Brilliant aurora in zig-zag bands from S.W. to N.E.

SEPTEMBER, 1895.

- 24th. 10 P.M. Thin band of aurora to southward, at altitude 50° .

OCTOBER, 1895.

- 5th. 8 P.M. Auroral streamers round heavens, cream-coloured and yellow.
- 11th. 8 P.M. Auroral streamers, commencing at altitude 20° and forming apex in zenith, round horizon.
- 13th. 8 P.M. Auroral light in openings of clouds at S. and N.W., pale green.
- 14th. 8 P.M. Auroral streamers at E. rising from horizon to altitude 70° .
- 19th. 7 P.M. Auroral band, altitude 30 to 40° , with short streamers shooting up from it, E.N.E. and S.S.W.

- 20th. 7 P.M. Similar aurora to yesterday's.
 10 to 10.15. Brilliant auroral display.
 11.30. Broad band E. to W. across zenith.
- 21st. 8.15 to 30 P.M. Brilliant aurora, altitude 20 to 80°, N.E. to S.W.
- 26th. 4 P.M. Slight auroral cloud-like light at E.S.E, altitude 10°.
 8.30 P.M. irregular band of cloud-like aurora, from E.N.E. to W.S.W., altitude 10 to 15: short streamers from it.
- 28th. 7.30 P.M. Aurora.
 11 P.M. Aurora, pale green, lateral motion from E. to S.W., altitude 5 to 80°.
- 29th. 8 P.M. Irregular spiral auroral bands from E. across zenith to W.

NOVEMBER, 1895.

- 2nd. 4 A.M. Auroral streamers S.E. to N.W.
 MDN. One streamer at W., altitude 20°.
- 3rd. MDN. One streamer at W., altitude 20°.
- 4th. 4 A.M. Band from S.E. to N.W. across zenith.
- 6th. MDN. Cloud-shaped (cum) auroral light moving from behind stratus cloud from S.W. to S. at altitude 2°.
- 8th. 6 P.M. Streamers from E. to S., 20° to 30°; one band above the other; lateral motion; pale green.
- 9th. 2 P.M. Pale short streamer at E., altitude 15°.
- 12th. 2 P.M. Auroral band across zenith from E.N.E. to W.S.W.
 4. Auroral streamer at E.N.E.
 6. Two arched bands from E.N.E. to W.S.W. at altitude 20° to 40°.
 7.55. Streamers at S.E., altitude 10° in centre of base, which extended from E.S.E. to W.S.W., of prismatic colouring. Thick streamers were formed in layers toward zenith, pyramidal in shape. It moved toward zenith scintillating, formed corona, long bands and waves of thick rose and green coloured light with serpentine movement, sent out streamers to N.N.W. shooting toward horizon, and widening out to N. and W.; finally seemed to rise in space and gradually disappear.

10. Three indistinct cloud-like auroral bands, arched, altitude 10° to 30° E.S.E. to W.S.W.
MDN. Arched streamer S.W. to N. across zenith.
- 13th. 2 A.M. Cumulus-like patches of auroral light at S. and S.S.W., altitude 70° .
4. Streamers from N. to S., altitude 45° .
6. Streamers across zenith, N. to S.
8. A few streamers at W.S.W., W. and N.W., at various altitudes, suddenly appearing and vanishing.
4 P.M. Five bands of auroral light radiating from common point at altitude 15° , and extending to zenith.
MDN. Cloud-like patches at southward, altitude 80° .
- 14th. 4 P.M. Three auroral bands across zenith from E. to W., meeting on each horizon in common foci.
6. Three similar bands, altitude 20° to 50° in centre.
8.30. Three similar bands, altitude 15° to 30° , from E.S.E. to W.S.W.
MDN. Cloud-like patches at S.S.W. and W., near zenith.
- 15th. 2 A.M. Brilliant corona, streamers from E.N.E. and S.W.
2 P.M. A few pale streamers at N.W., altitude 2° to 10° .
4.10. Brilliant aurora. Eight thick bands from E. to W. gradually opening out to zenith; rapid lateral movement. Formed corona in zenith with serpentine and circular motion, which sent out some streamers to N.E. The main bands did not pass the zenith, but after playing about in all directions grew very faint.
4.30. Brilliant prismatic colouring in fringes of bands. All bands met in common foci at E. and W.
5. Aurora appeared more distinctly and spread over all heavens in bands, and in circular and scroll-like forms.
6. Band across zenith from E. to W.; very faint arch at N.W. formed by short fringe of streamers.
- 16th. 8.25 P.M. Long arched band of streamers from E.S.E. to W.S.W., lateral movement W. to E.; altitude at centre 20° ; prismatic colouring.
10. Huge mass of streamers from common point at E. up to zenith and round to S.W., like column of smoke.

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18th. 2 A.M. Streamers at W. and N.E.

4. Streamers at S.W. Faint corona in zenith.

MDN. Faint broad streamer E.N.E. to zenith.

19th. 2 A.M. Streamers over whole of heavens ; corona.

4. Faint streamers N.E. to S.W.

6. A few auroral patches at W. Band across zenith from N.E. to S.W.

9 P.M. Brilliant arch of auroral streamers from E. to S.W. ; altitude at centre 40° .

10. Fringed band from E.S.E. to S. ; altitude 10° .

20th. 2 A.M. Two streamers at S.W.

4. Faint streamers from N.E. to S.W.

6. Faint band E. to W.

6.15 P.M. Three fringed bands with streamers shooting up towards zenith to altitude 60° , pulsating and moving laterally from S. to E.

10.15. Arched fringe of streamers from E. to S.W., altitude at centre 20° ; another band under S.W. extreme of fringe, and separate from it.

MDN. Brilliant streamers all over sky.

21st. 6 P.M. Aurora commencing in band of streamers from E.N.E. to S.W., shooting upwards to zenith, forming pyramidal shape and corona, which shot out streamers all over heavens, and finished as it commenced in band from N.E. to S.W.

8.10. Intermittent streamers from N.E. to S.W., altitude 45° .

10. Long irregular fringe of streamers from E.N.E. to W.S.W., altitude at centre 12° .

22nd. 2 P.M. A few streamers at N.W., altitude 10° to 40° .

4. Irregular bands of streamers from W. to E.N.E., altitude at centre 60° .

6. One streamer at W.N.W.

8. Faint band from E. to S.W., altitude 20° .

10. A double band of fringed streamers from E. to S.W., altitude 5° to 10° .

MDN. One streamer at E.

23rd. 2 A.M. Brilliant corona with streamers from it all round heavens.

4. Corona in zenith. Streamer from it to N.
 4 P.M. Band from E. to S., altitude 10° to 20° ; streamers at E.
 6. A band from S.E. to S.W., altitude 10° .
 8. Cloud-like auroral light at E., altitude 5° .
 10. Bands, altitude 10° to 15° , from E. to S.W.
 MDN. Streamers at zenith, S.W. and S.
- 24th. 2 A.M. Streamers at S.W.
 6. Streamers radiating from zenith all round horizon, down to 10° from horizon.
 8. Streamers at S. and S.W.
 NOON. Faint arch from E.S.E. to S.W., altitude at centre 15° .
 2.40 P.M. Brilliant aurora, spiral-shaped from W. to E., darting like flame from E. to W., opened out to N. and S. in several bands, sent out streamers from E. through N. to W., extending to 10° altitude at 2.45.
 2.50. Formed complete corona, soft green colour throughout, spiral shape, very thick. Observed stars of small magnitude, and gave faint but distinct light.
 3. Broad mass of auroral light from E. to W. across zenith.
 6. Broad band from W. to N., altitude 3° to 20° .
 8. Streamers round heavens to 10° from zenith. Thick base, altitude 10° to 20° . All stars (except "a Coronæ") of Corona Borealis obscured by one thick patch of auroral light.
 10. Corona and brilliant streamers (pale green) all round heavens in successive layers, one above the other, especially to E., S. and W. The Pleiades dimmed, but not obscured, by this aurora.
- 25th. 2 A.M. Streamers at S.W.
 4. Streamers at S.W.
 6. Streamers at zenith, broad band from S.W. to N.E.
 NOON. A few small streamers at N.W.
 2 P.M. Bands across zenith from W. to N.
 4. Streams at N.E. extending to 10° from zenith.
 10. Brilliant corona in zenith, soft green colours; sent out one long streamer to E. and another to W., which

spread out to N.E. and S.W., and at 10.12 had spread all round heavens, leaving a thick track of light in its path at base of streamers as it moved along.

26th. 4 P.M. Two auroral bands from E. through S. to W.S.W., altitude at centre 20° .

8. Cloud-like patch of auroral light moving bodily from E. to S., and sending out a fringe of streamers back to E.; variously coloured.

28th. 8 P.M. Streamers at N.W.

30th. 4. Arch from E.S.E. to W.S.W., altitude in centre 10° ; very faint.

6. Similar aurora.

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8th. 2 P.M. Streamers from between E.S.E. and W.S.W., fan-shaped, visible between 20° and 70° altitude; base and apex obscured by clouds.

11th. NOON. Streamers at N. and N.W., altitude 10° to 70° .

2 P.M. Fringe of streamers from N.W. to N., altitude 10° to 50° .

4. Similar aurora.

MDN. Broad faint streamers at N.N.W. and S.W.

12th. 2 A.M. Streamers from W. to E., altitude 10° .

4 P.M. Numerous disconnected streamers from W. to E., across zenith, moving bodily to southward.

6. Arched band, streamers from it E. to W., altitude 5° .

8. Disconnected band, or arch, of streamers from E.S.E. to W.S.W., at altitude 15° .

12th. MDN. Streamers at S.E., S. and S.W.

13th. 2 A.M. Faint auroral light at S.S.W., streamers at S.W.

14th. 4 to 6 P.M. Brilliant arch of streamers from E. to W. Altitude of centre at 4 P.M. 10° ; at 4.40, 60° , when it remained until 6 P.M., pulsating both ways, prismatic colouring constantly renewed. The aurora cast a faint but distinct light, making the rocks of Cape Flora and the clouds show out more distinctly than is usual. It also caused an ill-defined faint shadow.

- 15th. MDN. Faint streamers at E., altitude 40° .
- 17th. 2 P.M. Fringe of streamers from W.N.W. to N., altitude 30° .
4. Three arched bands, one in zenith, two at altitude 30° E. to W.
8. Brilliant display, corona at zenith, streamers all round to 5 and 10° from horizon, circular masses at base, prismatic colours, faint diffused light, apparently blown to S.W. by wind, force 10.
10. Arched band of light from E. to W., 40° at centre.
- MDN. Brilliant streamers from E.N.E. to S.W., through zenith.
- 18th. 4 P.M. A few streamers W.N.W. From 4 to 8 P.M. Two arched bands from E. to W., altitude at centre 15° , occasionally sent up streamers towards zenith.
10. Brilliant corona at zenith with circular motion, sending out streamers and vast sheets of light at E., moving slowly and bodily toward E., fringe of streamers from E. through S. to W.S.W., altitude 20° .
- MDN. Brilliant streamers from E.N.E. through zenith to W.S.W.
- 19th. 2 A.M. Broad faint streamers at S.
4. Faint band at S.E.
6. Band of streamers from N.E. to zenith.
8. A few long streamers from horizon toward zenith, N. and N.W.
- 2 P.M. Band of streamers across zenith from E. to W.
- MDN. Luminous patch at W.
- 20th. 2 A.M. Streamers from E.N.E. through S. to W.
4. Faint band at S.E., and faint streamers near zenith N.W. of it.
- 4 P.M. Arched band from E. to W. Centre passed over Cassiopeia. Another forming slightly N. of it.
6. Two wavy arched bands from E. to W. across zenith.
10. Circular mass of streamers, altitude at base 3° , top of streamers 23° , from S.E. to S.W., lateral pulsating motion toward *both* extremes, cast faint light.
- MDN. Very faint luminosity from E. to W. through S., altitude 8° .

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21st. 2 A.M. Similar aurora.

MDN. Short streamers from E.N.E. to W., altitude 5° .

22nd. 6 A.M. Faint corona in zenith, short streamers from it round heavens.

8. A few short streamers at N.W., altitude 15° .

10. Faint corona in zenith with long streamers to E. and W.

NOON. Broad mass of auroral light from E. horizon to zenith.

2 P.M. Auroral bands from E. through S. to W., variable altitude 5 to 60° ; at 4 P.M., altitude 20° to zenith.

8. Five wavy bands from W. to E.; the lowest at N. altitude 40° at centre; altitude of lowest at S. centre 70° .

MDN. Streamers at W., altitude 5° .

23rd. NOON. Irregular wavy band of connected streamers from E. across zenith to W.

4 P.M. Thick wavy band from E. to W. across zenith.

10. Brilliant display; corona at zenith sending out vast sheets of light to southward and eastward, streamers in other directions. Fringe of streamers moving with exceeding rapidity laterally through N. to E. at altitude 40° , recurving again toward N. Brilliant prismatic colours.

MDN. Streamers at W., S.W. and S., altitude 6° .

24th. 2 A.M. Faint broad patch at S.

4. Faint corona at zenith, with short streamers round heavens.

6 A.M. Faint band from E. to W.

8. A few streamers at N. and W.

10 P.M. Irregular cumulus-like auroral patch at zenith. A few short streamers at E. and S.E., and one band.

MDN. Faint auroral patch at W.

25th. 4 A.M. Faint streamer at zenith.

26th. 2 A.M. Auroral band E. to W., altitude 10° at E., 15° centre, horizon at W.

6. Streamers from N. to W., and at S.W.

8. Faint streamers at N.W., altitude 50° .

2 P.M. Arched band from W. through N. to E.N.E., altitude 40° at centre.

6. Arched fringe of streamers from E. to W., altitude 50° at centre shaped.

8. Faint band from E. to W.

10. Three disconnected arched bands from E.S.E. to W.S.W., altitude at centre 5° . Low bank of cloud at W.

27th 2 A.M. Streamers at S.W.

8. Two irregular shaped auroral patches at zenith, with a few short streamers from them : appearing about to form corona.

31st. 10 P.M. A short faint streamer at S.

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2nd. 2 P.M. Arched band from E. through S. to W., altitude 80° .

4. Similar aurora.

8. Circular mass of auroral light at S.E., altitude 40° .

MDN. Streamers at W.S.W. through zenith to E.

3rd. 4 A.M. Auroral bands thickly massed across zenith, especially from E. to W.

4 P.M. A few streamers at S.E., altitude 18 to 50° .

8. Wavy band from W. to E.S.E., altitude 5 to 20° .

4th. 2 A.M. Thin band at zenith from N. to S. Faint streamers W. through S. to E., altitude 30° .

6. Streamers radiating in every direction from zenith, especially to E. and W.

8. A few cumulus-like patches at N.W. and short streamers at N. and N.E.

2 P.M. Semi-corona at zenith with layers of thick streamers to between E. and W.

4. Broad wavy mass of light from W. to E., moving rapidly and bodily to S.

6. Arched band from E.N.E to W., altitude 20° at centre.

10. Faint circular masses of auroral light from zenith to horizon between N. and W.

MDN. A few short streamers at S.E., altitude 5 to 10° .

6th. 2 P.M. Faint irregular bands from E. to W. across zenith.

6. Auroral light showing on a ragged edge of clouds.

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- 10th. 6 A.M. Broad faint band from E. to W.
2 P.M. Broad, thick, irregular band from E. to W. across zenith. Breadth from Polaris to Vega appearing to rise and move laterally to southward.
6. Bands from E.N.E. to W.S.W., altitude 20 to 40°.
8. Auroral light in large faint patches in zenith and on edges of clouds to S. and S.E. At 10 P.M. light on edges of cloud to E. and S.
- 11th. 4 P.M. Irregular thick arched band from W. through Ursa Major (below the pole) to E.N.E.
MDN. Faint patches of aurora in zenith.
- 12th. 2 A.M. Streamers between S. and E., altitude 5° to zenith; misty on horizon to southward. Brilliant irregular streamers covering heavens with exceptions of 2° above horizon.
6. Faint streamers at W.
2 P.M. Thick wavy bands from W. through zenith to E.
4. A few streamers to N. and N.W.
10. Auroral light on edges of clouds to southward.
MDN. Faint patches at W., N.W. and E., altitude 5°.
- 13th. 2 A.M. Streamers over whole heavens from 2° above horizon.
8 P.M. Arched band from E. to W.S.W., altitude 15° at centre, short streamers rising from it to altitude 30°, appearing to make for common point in zenith.
10. Similar aurora.
- 14th. 2 A.M. Corona in zenith; streamers from it at E.N.E. and S.
4 P.M. Arched fringe of streamers from E. to S.E., altitude at S.E. 20°.
6. Similar aurora in different layers.
10. Corona at zenith; streamers radiating round heavens from it to 20° above horizon.
MDN. Auroral lights at S.W., altitude at 30°. Faint light on edges of cloud at S.
- 15th. 2 A.M. Fringe of streamers through S. to E.N.E.
6. Faint streamers at zenith to W.S.W.
8. Streamers at N. and N.W. radiating from zenith to 30° above horizon.

- NOON. Streamers at N., N.W., and N. extending in detached layers to horizon. At 2 P.M. similar aurora.
- 4 P.M. Thick curved band from E. across zenith to W., and thick circular patch at zenith apparently composed of steamers moving bodily W. and into space. At 8 P.M. similar.
10. Corona at zenith having circular motion, short streamers radiating from it round heavens and moving bodily to S.E.
- MDN. Arched band from W.N.W. to E.N.E., altitude at centre 50° .
- 16th. 2 A.M. Faint auroral light at S. at edge of cloud just above horizon.
- 17th. 6. Faint corona at zenith.
8. A few streamers at N. and N.W.
- 4 P.M. Bifurcated band from E. through S. to W., altitude at centre 20° , streamers at each extreme. Arched band from E. through N. to W., altitude at centre 70° .
6. Most brilliant aurora. Circular masses at W.S.W., shooting out thick bands and streamers to E.N.E. Fringes bright green or deep rose, recurring, scintillating, darting, and moving like running water both ways. Corona in zenith. Aurora commenced at 5° above horizon, and had more colour than any we have yet seen. It threw out a more distinct light than any yet recorded. Once or twice the colours appeared to be deep rose, mauve, and purple. It was most brilliant during twelve minutes shortly after 6 P.M.
- 6 P.M. The magnet suspended in magnetometer vibrated quickly both ways.
8. Wavy irregular band across zenith from W. to E., curving toward N. near E. horizon.
10. Faint corona, faint streamers radiating from it round heavens.
- 21st. 4 A.M. Faint band at S.E.
- 6 P.M. Band, altitude 15° ; streamers each extreme at E., N.E., and S.
- 22nd. 4 A.M. Band from E. through S. to W., streamers from it toward zenith.

MDN. Faint light above frost-smoke. Streamers at N.N.W., altitude 20° .

30th. 10 P.M. Streamers at E. and N.E., moving rapidly northward, altitude 70° . Very indistinct because of moon's light.

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3rd. MDN. Bright patch above, and appearing from behind stratus cloud, from E. through S. to W. Irregular band of streamers from N. through zenith to S. A streamer from E. to W., altitude 10° .

4th. 6 P.M. Circular masses and fringed bases all round heavens, altitude 10° .

10 Faint aurora, streamers radiating round heavens, heavy circular bases at altitude 10° .

5th. 2 A.M. Streamers from W. to E.N.E., rapid movement. From 4 to 6 A.M. streamers at W.

6 P.M. Arched bands from E.N.E. to W., altitude 10° . to zenith, indistinct.

MDN. Streamers at S., altitude 7° .

6th. 6 P.M. Irregular disconnected band from E. across zenith to W.

8. Broad band from E.N.E. across zenith to W., another through S. to W., altitude 60° .

7th. 2 A.M. Faint streamers from zenith to 5° above W. horizon.

4. Similar aurora, very faint.

10 P.M. Corona in zenith, streamers radiating from it to between E.N.E. and W.S.W. (through E. and S.) down to 10° above horizon. Short streamers extended 3° from zenith to other portions of heavens. Streamers at E. very thick. Heavy circular bases at westward.

MDN. Streamers from E. through S. to W., altitude 35° .

8th. 2 A.M. Streamers at S.

8 P.M. Brilliant aurora. Streamers from E.N.E. through E. and S. to W.S.W. gradually extended to and formed corona in zenith. Streamers thickest at E. extreme. Corona formed against the watch by sinuous circling bands. It sent out streamers to N.W., other streamers folding

round from E. to W. toward N.W. The whole appeared to move bodily from S.E. to N.W. laterally, and pulsating both ways. Various shades of green in colour. Magnetic needle barely affected. Aurora apparently distant. Aurora similar to this formed between 8 and 10 P.M. ; as one faded another came on.

MDN. Streamers from E.N.E. to S.W., altitude 5° .

- 9th. 2 A.M. Streamers from E.S.E. to N.N.E. ; patch at N.W., altitude 2° , and at S.S.W., altitude 3° .
- 4. Streamers from E. to W., altitude 20° .
- 10th. Faint streamers at S., altitude 40° .
- 6. Streamers from N.E. to S.W., and from N. to zenith.
- 11th. 8 P.M. Corona at zenith, streamers radiating round heavens from it at 10 to 20° from zenith.
- 10. Auroral arch, altitude 30° , from S.S.E. to W.S.W., shaped.
- 13th. 4 A.M. Streamers at S., altitude 20° .
- 6. Auroral patch at S., streamers from S. towards zenith.
- 14th. 2. Streamers radiating from behind stratus clouds all round the horizon and forming a corona at zenith.
- 4. Faint corona at zenith, streamers at N.
- 6. Streamers from S.W. and N.E. toward zenith, quickly disappearing and being reproduced. Very clear round horizon.
- 6 P.M. Fringed base of streamers round heavens at 10° to 30° altitude. Indistinct streamers at E.N.E. extending to zenith, lateral motion from east to west.
- 8. Two faint arches from E. across zenith to W.

MDN. Streamers at S., altitude 60° .

- 17th. 6 P.M. Band across zenith from E.N.E. to W.S.W.
- 8.10 to 8.30. Brilliant aurora. Corona at zenith faded away quickly. Four bands apparently commenced at W.S.W., altitude 5° , and spread round through S. to E., altitude at E. 60° , through N. meeting two other bands which commenced at W., altitude 5° , and spread round to N. at altitude 50° . The bands from W. to N. moved laterally from W. to N. They formed into a sinuous band at W. and moved exceedingly rapidly from N. to S.,

and then curved rapidly toward W. All the bands were fringed. Could barely distinguish very faint streamers rising from the bands.

19th. 6 P.M. Broad band from E.N.E. through N., altitude 70° . to W.N.W.

8. Faint band across zenith from E. to W.

29th. Irregular bands of auroral light from E. to S., altitude 5° to 20° .

SHORT STATEMENT UPON THE GEOLOGY OF FRANZ
JOSEF LAND. BY REGINALD KOETTLITZ, M.R.C.S.,
L.R.C.P., ETC., OF THE JACKSON-HARMSWORTH
POLAR EXPEDITION

THAT Franz Josef Land is not the extensive land that it was supposed to be by Payer and Leigh Smith will be gathered from Mr. Jackson's narrative. We now know it to be nothing more than an archipelago of small islands. (See paper in "Quarterly Journal Geological Society," Vol. 54, p. 620, 1898.)

The geology of these islands teaches us that they are the remains of a fairly extensive table-land, which there is every reason to believe was once connected with other land, from which it is now separated by a considerable expanse of sea.

The most conspicuous rock, and the one that first strikes the visitor to these shores is the basalt, which gives the country its distinctive flat-topped table-land character. This crowns those spots which the perpetual ice and snow does not hide. It is a fine black-looking rock arranged for the most part in layers or tiers, which are very distinct and can be seen at a great distance upon the headlands, and few protruding rock masses. I use the word *few* because the surface is almost entirely covered by ice, and it is only at rare intervals that a bare spot can be seen.

Upon close examination the layers or tiers, which represent successive flows of basalt at varying intervals of time, are seen to be separated by layers of softer material, which weathers and crumbles more readily than the harder rock; the result being that the tiers rise one above another in a succession of terraces, which are high or low according to the thickness of the bed. The total thickness of these basaltic layers is about seven hundred feet; its base is generally from four hundred to six hundred feet above sea

level, and its upper limit, in some places, is not far short of one thousand three hundred feet.

Nearly all the basalt—at least of the southern and western portions of the land—is of the same type. Mr. J. J. H. Teall, of the Geological Survey, who has carefully examined and reported upon it ("Quarterly Journal Geological Society," Vol. 53, p. 482), defines it as consisting of "glomero-porphyrific aggregates of basic plagioclase and augite, in a groundmass of lath-shaped labradorite, augite, and interstitial matter." Some of this is massive and compact, but much of it is vesicular and amygdaloidal, the amygdaloids being formed of palagonite calcite, analcime, natrolite, chalcedony, and quartz. Underlying this basaltic rock, extending from sea level to, in some places, 600 feet above, are strata of soft clay-shales, sand, coal, and lignite, with an occasional boss in it of hard sandstone. Among them also occur strata of a foot or two in thickness of sandstone, or ferruginous mudstone, and at one spot of bituminous paper shales.

Many of these strata contain fossils, both plants and animals, many of which have been identified by Mr. E. T. Newton, of the Geological Survey (see *ibid* p. 493). The strata around Cape Flora yielded Ammonites (*Cadoceras*) *Tchefkini*, *A. modiolaris*, *A.* (*Macrocephalites*) *Macrocephalus*, *A. Lamberti*, *A. Ishmæ*, *Belemnites Panderi*, as well as other species; *Pecten demissus*, *Aviculæ*, a new *Inoceramus*, &c.

Near the sea level at Cape Stephen a bed filled with plant remains was met with, and these have been referred to *Phyllothea*, *Rhoptozamites* (?), *Anomozamites* (?), *Zamiopteris*, and *Asplenium*. A coal seam some two to three feet thick was found near here, at about 300 feet above sea level.

Fossil plants were also discovered in some stratified rock between the tiers of basalt, associated with the coarse material which composed the softer layers between the tiers, which have been referred to above.

Some of these plants Dr. Nansen, who was with us for seven weeks, brought back with him, and they were examined by Dr. Nathorst. They consist of pine needles and seeds, ferns, two species of ginkgo (one new), &c., such as *Pinus* like *Nordenskiöldi*, another species with narrow needles, and seeds like those of *Pinus*

Maakiana, Taxites, probably *T. gramineus*, Feildenia, Gingko (new) named *polaris* (Nath.), another Gingko, Czekanowskia, Cladophlebis, Thyrsopteris (?), Onychiopsis (?), and Asplenium, near to *A. petruschinense*.

The stratified rocks beneath the basalt are remarkable for their extraordinary number and diversity of colour; for the most part they are layers of clay-shale, and sand with lignite; much of the latter is false bedded also, and points to frequent oscillations of level, and rapidly varying conditions of deposition.

The lowest beds found are a series of shales and sandstones containing fossil-plants and lignite, showing evidence of littoral or estuarine conditions. Above these are some of purely marine formation, containing the above-named Ammonites, Belemnites, &c., which seem to be intimately associated with the more shallow water beds. These marine fossils are so characteristic of special zones that the age of these beds is fairly well established to be that of the Callovian and Oxfordian of the Jurassic period.

The finding of *Ammonites macrocephalus* in Franz Josef Land extends the range of this ammonite several degrees more to the north than it was previously known to occur; and the plant-bearing beds, in association with those containing this ammonite, shows that a coast-line at no very great distance must have existed.

These soft rocks therefore, known to be of Jurassic age, were subsequently covered up by successive flows of basalt, and the question arises as to when these flows took place, and whether they were deposited upon the surface as lava, or whether intruded between older strata, as intrusive sills.

Contrary, I believe, to the opinion of others who have examined the specimens brought home, I consider them to be of Jurassic age. Having had the advantage of examining the rocks *in situ*, I have gained a clearer conception of their conditions than can be possibly obtained by description. My reasons for thinking them of this age, and not Tertiary like the basaltic formations of Scotland, &c., are—

- (1) That the lowest bed of the series has tuff-like material underlying it; so have also other tiers, which proves the flow to have been sub-ærial and not intrusive.
- (2) The layers of basalt are vesicular on their upper and

lower surfaces and compact in the centre, which also points to non-intrusion.

- (3) In the middle tiers of the basalt I have discovered large masses of fossil-wood enclosed in it, and also wood charred into charcoal.
- (4) The stratified rock between the tiers being only thin strata, continue so level, and show so little evidence of displacement, that they must have been laid down where they now are, and it appears impossible that the basalt could have been intruded underneath them.
- (5) That in association with these stratified beds are layers of tuff.
- (6) Where the basalt is in contact with these stratified rocks they do not appear to be materially altered by heat.
- (7) That in these strata I found fossil-plants which are considered to be of Upper Jurassic age.

These reasons appear to me to be conclusive as to their age, if the date assigned to the fossil-plants be correct.

The basalt at certain spots is to be found at sea-level, and appears to be the remains of dykes, while at another place it looks like a neck which originally filled a volcanic vent, through which the lava found its way to the surface.

The evidence of considerable elevation of the land above sea-level at a comparatively recent date is very marked, the more recent being shown by a continuous series of terraces of beach lines covered with rounded, rolled, water-worn stones up to a height of over four hundred feet: these are especially well shown upon Bell Island. Upon many of these raised beaches the remains, in the form of bones, of seal, walrus, and whales are to be found.

But higher still, even to the summit of the rocks, the highest position being the summit of Cape Flora, 1111 feet in height, rolled, rounded, water-worn stones are also to be seen, and even, as upon the plateau upon the top of Cape Neale, 700 feet high, the whole skeleton of a seal was found. As a consequence of the more lengthened period since these higher parts of the land rose above the sea, the proofs of their having been under sea-level are not so marked as on the lower land, the rocks and rounded stones having been much weathered and broken up

since. Seeing, however, that some raised beach-terraces are unmistakable for half the distance in altitude, and that there are similar conditions at all altitudes, it is tolerably clear that in comparatively recent times the whole land surface has risen from below sea-level.

The geological facts discovered show that, during the time the basalt was being poured over the surface, the climate was very different to what it is now : trees and plants were growing upon it, luxuriant verdure clothed the surface, and, judging by the species and genera of plants, the climate was cool but mild and genial.

It was at the same time connected, in all probability, with other lands, most likely, judging by the similarity of the basalts, with Spitzbergen, Scotland, Ireland, the Faroe Islands, Iceland, Jaulleayan, and Greenland.

There is a possibility that the land was at an earlier epoch connected with Northern Europe and Siberia.

NOTES ON A COLLECTION OF ROCKS AND FOSSILS
FROM FRANZ JOSEF LAND, MADE BY THE JACKSON-
HARMSWORTH POLAR EXPEDITION DURING 1894-
1896. BY E. T. NEWTON, ESQ., F.R.S., F.G.S., AND J. J. H.
TEALL, ESQ., M.A., F.R.S., V.P.G.S.*

I. INTRODUCTION.

THE steamship *Windward*, which has now paid two visits to Franz Josef Land, brought back last year (1896) a series of rocks and fossils, collected by the Jackson-Harmsworth Expedition. This collection, by far the most important which has reached this country from Franz Josef Land, was forwarded to the Geological Survey, and at the request of the Director-General, Sir Archibald Geikie, we have undertaken its examination. Although the full results of the geological observations recorded by Dr. Koettlitz cannot be made known until the return of the Expedition, it has been thought desirable that a preliminary account of the district, based on the specimens already received, should be published.

II. PREVIOUS WORK ON THE GEOLOGY OF FRANZ JOSEF LAND.

The geological literature relating to Franz Josef Land, though small in amount, is sufficient to prove that those portions of the district which have as yet been visited possess a comparatively simple geological structure. Scattered observations have now been made over more than two degrees of latitude by Payer, Leigh Smith, Jackson, and Nansen, and everywhere the features observed appear to be essentially of the same character. It is a region of plateau-basalts comparable, not only in its main features, but also in many of its minor details, to portions of the western coast of Scotland. Vast flows of basaltic lava, associated in all probability

* Extracted by permission from the "Quart. Journ. Geol. Soc." vol. lii. p. 477 (1897). See also same Journal 1898, p. 646.

with intrusive sills of the same type of rock, form the greater portion of the district. Sometimes the basalt descends to the level of the sea, and sometimes, as at Cape Flora, rests on some 600 feet of nearly horizontal strata of Jurassic age. It may be safely predicted that if the capping of snow and ice which conceals so large a portion of the district were cleared away, the geological aspect and physical features of Northbrook Island would be very similar to the northern part of the Isle of Skye, where basaltic lavas and intrusive sills are associated with nearly horizontal strata of Jurassic age.*

The geological observations made by the members of the Austro-Hungarian Polar Expedition under the command of Lieuts. Payer and Weyprecht were necessarily of a limited character. Payer calls attention to the plateau-like aspect of the land in the neighbourhood of Cape Tegethoff, the southern promontory of Hall Island, and to the fact that the plateau terminates with steep precipitous rocks.† He refers also to the occurrence of dolerite (the general term applied to the rocks by Prof. Tschermak) on Koldewey and Schönau Islands, that of the latter being remarkable for its beautiful columnar structure. He states generally that dolerite is the prevailing rock, but refers also to the occurrence of sandstones and of a shale containing white mica and plant-remains. There is no means of correlating the latter rocks with the beds discovered by Dr. Koettlitz, of the Jackson-Harmsworth Expedition. The common occurrence of silicified wood is also noticed by Payer, and wood of this character is abundant in the present collection. The ship *Tegethoff* was abandoned, and only a few specimens appear to have been brought back. In his general remarks on the geology of Franz Josef Land, Payer clearly recognises that it forms a part of an extensive volcanic province, stretching westward through Spitzbergen, Jan Mayen, and Iceland to Greenland.

The voyages of Mr. Leigh Smith in the *Eira* furnish additional information of importance as to the geology of Franz Josef Land. From the account of the first voyage in 1880 given by Mr. (now

* See "The Tertiary Basalt-plateau of North-western Europe," by Sir A. Geikie, "Quart. Journ. Geol. Soc." vol. lii. (1896) p. 331.

† "New Lands within the Arctic Circle." See also "Proc. Roy. Geogr. Soc." vol. xix. (1874) p. 17.

Sir) Clements R. Markham* we learn that May Island, the first land reached, is 200 feet in height, and formed of basalt. Cape Barents, the south-eastern promontory of Northbrook Island, is formed of "columnar basalt like the Giants' Causeway." It is stated that while the ship was in Eira Harbour, Mr. Grant walked along the shore to the eastward, presumably on Mabel Island, and afterwards ascended with a party to the summit of the hill overhanging the harbour (Bell Island?), which proved to be 1040 feet above the sea. "On the slope of this hill a good deal of petrified wood was collected, and some other fossils." It is further stated that "the lowest rocks belong to the Oxford Clay, and are represented in the collection brought home in the *Eira* by two belemnites. Above the Oxford Clay the rock is of the Cretaceous period to which the fossil coniferous wood belongs, including one very perfect cone. There are also slabs with impressions of plants. Over all these has been an overflow of basalt and lava, forming a cap, as on the island of Disco." In the discussion which followed the reading of the paper, Mr. Etheridge referred to the widespread distribution of the basalts, which he regarded as being probably of the same age as those of the Giants' Causeway.

During the second voyage of the *Eira* in 1881, which unfortunately terminated in the loss of the ship, a raised beach, 90 feet above sea-level, was found in Gray Bay, and cliffs of columnar basalt, 800 feet in height, were observed at the same locality.† Fossil wood was found on David Island.

Dr. Nansen's book, "Farthest North," contains many references to the geology of the parts of Franz Josef Land visited by him. The first rock touched in his memorable journey towards the south is described as a coarse-grained basalt,‡ and he refers to the occurrence of basalt on the western coasts of Karl Alexander Land and Frederick Jackson Island; also at Capes McClintock, Fisher, and Richthofen. In justice to Mr. Jackson it should be remembered that he had visited most of these localities in 1895, and had observed the occurrence of basalt.

* "Proc. Roy. Geogr. Soc." n. s. vol. iii. (1881) p. 129.

† See the account of the voyage by C. R. Markham, "Proc. Roy. Geogr. Soc." n. s. vol. v. (1883) p. 204.

‡ Vol. ii. p. 306. In his diary the rock is called a granite, but in a footnote he adds that it was a coarse-grained basalt.

In many places the rock exhibited the characteristic columnar structure in the most perfect manner. While staying with Jackson at Cape Flora, Dr. Nansen examined the geological structure of the neighbourhood of that cape, the points of interest being shown to him by Dr. Koettlitz, the doctor and geologist of the English expedition. The basalt appears at a height of 500 or 600 feet, and below this is a soft clay containing lumps of an argillaceous sandstone, in which fossils occur. At first Dr. Nansen held the view that the stratified deposits belonged to a late beach-formation, but Dr. Koettlitz showed him that these deposits actually passed underneath the basalt. Dr. Nansen also observed thin strata of basalt in the clay, below the main mass. The fossils were mainly ammonites and belemnites, and these convinced him that they belonged to the Jurassic period. The main mass of basalt was coarser in grain than in ordinary basalt, and resembled the so-called "diabases" of Spitzbergen.

Dr. Nansen points out that the situation of the basalt on Northbrook Island is different from that which had been observed farther north. Here it was found at a height of 500 or 600 feet, whereas north of latitude 81° , at Capes Fisher, McClintock, Clements Markham, and many other localities, it descended to the sea-level. He regards the basalt as in great part of Jurassic age.

Mr. Jackson and Dr. Koettlitz discovered innumerable fragments of rock, containing plant-remains, resting on a mass of basalt which, at a height of more than 700 feet above the sea, projected through the glacier on the north of Cape Flora. Dr. Nansen was taken to this spot by Dr. Koettlitz, and they brought away a number of specimens, some of which were submitted to Dr. Nathorst, and determined by him to be of Upper Jurassic age. The fact of these fossils having been found on the basalt also influenced Dr. Nansen in referring this rock, in part at least, to the Jurassic period. Evidences of recent changes in the relative level of land and sea are referred to in Dr. Nansen's book. Thus, Mr. Jackson's hut is built on an old beach 40 to 50 feet above sea-level, and other beaches were found at still greater elevations. Raised beaches were also observed farther north, in the neighbourhood of the hut in which Dr. Nansen wintered.

A number of geological specimens were sent home by Mr.

Jackson and his party when the *Windward* returned in 1895, and a short note on some of these was appended by our colleague, Mr. G. Sharman, and one of us to Mr. Montefiore Brice's report of the Expedition.* The much larger series of specimens, of both rocks and fossils, which has now been received, throws additional light on the geological structure of the Franz Josef Land archipelago. Although the cliffs are so largely hidden by talus-heaps and snow, that exposures of rock are few and far between, yet the specimens now collected by Mr. Jackson's party have all been so carefully labelled and localised that it has been possible to piece them together, so as to present what we believe to be a correct idea of the geology of some of the southern parts of Franz Josef Land. We have received much help from Mr. H. Fisher, the botanist of the expedition, who is now in England: his admirable coloured sketches and verbal descriptions doing much to aid us in realising the actual conditions under which the specimens were found. Moreover, Mr. Fisher's patience in answering our innumerable and perplexing queries has helped us out of many difficulties, and we take this opportunity of tendering him our warmest thanks. We are also under obligation to Dr. G. J. Hinde for many hints, but especially for his Note on the radiolarian chert from the iceberg. We have moreover received help and many kind suggestions from our colleagues, Mr. Clement Reid, Mr. G. Sharman, and Mr. W. W. Watts, and we desire to thank all these friends, and to acknowledge our indebtedness to them.

III. THE BASALTS OF FRANZ JOSEF LAND.

The basaltic rocks which form so important a feature in the geology of Franz Josef Land are well represented in the Jackson-Harmsworth collection by specimens from Cape Flora and Hooker Island. All these belong to one type, although the specimens may be massive, vesicular, or amygdaloidal; but another and a distinct type is represented by one or two specimens obtained from the under-surface of an iceberg found, tilted up, in De Bruyne Sound, between Northbrook and Hooker Islands.

The common type will first be described. It is represented by

* "Geogr. Journ." vol. vi. (1895) p. 518.

specimens collected *in situ*, and from the talus which so commonly conceals the lower portions of the cliffs. As there is no essential difference between the specimens collected under these different conditions, they will be grouped together for purposes of description. In the fresh condition the rocks are very dark, almost black, and of medium grain. They weather in the manner characteristic of basaltic rocks, and sometimes break up into spheroids. Examined with a lens, the felspars are often seen to be of a yellowish colour, and the appearance of the rock under these circumstances is such as to suggest at first sight that olivine is an important constituent. This, however, is not the case; olivine does occur occasionally, but never in sufficient quantity to affect the macroscopic character of the rock.

A special feature of almost all the rocks of the common type is the tendency of some of the felspars to be somewhat larger than the others, and to occur in groups, thus producing a kind of glomero-porphyrific structure. A few specimens may be fairly termed "porphyritic basalts," but the porphyritic structure is never strongly marked in the hand-specimens, and is frequently not noticeable.

Vesicular and amygdaloidal rocks are extremely common at Cape Flora. This is a point of some interest, when considered in connection with Payer's remark that "amygdaloidal varieties, so common in Greenland, were never found in Franz Josef Land."* The cavities have been filled with various substances, such as calcite, analcime, natrolite, chalcedony, quartz, and palagonite.†

* "New Lands within the Arctic Circle," German ed. p. 267.

† The following analysis represents the composition of the common type of basalt:—

SiO ₂	.	.	.	.	.	47.28
TiO ₂	.	.	.	.	.	1.48
Al ₂ O ₃	.	.	.	.	.	13.24
Fe ₂ O ₃	.	.	.	.	.	4.44
FeO	.	.	.	.	.	10.50
MnO	.	.	.	.	.	.40
CaO	.	.	.	.	.	11.04
MgO	.	.	.	.	.	5.94
K ₂ O	.	.	.	.	.	.31
Na ₂ O	.	.	.	.	.	2.62
Loss on ignition	.	.	.	.	.	2.00
						<hr/> 99.25 <hr/>

Under the microscope the constituents are seen to be plagioclase, augite, magnetite, olivine, interstitial matter, and various secondary products. The plagioclase occurs in forms giving lath-shaped sections, and also as aggregates of somewhat larger individuals, which mutually interfere with each other, and are more equally developed in the different directions. A broad type of albite lamellation is common to both modes of occurrence, and the individuals of the larger aggregates often show, in addition, a zonal structure and twinning on the pericline-plan. The lath-shaped sections in a common type of rock measure about .5 mm. in length by .1 mm. in breadth; whereas the individuals which compose the larger aggregates may measure as much as 1 or 2 mm. in their longest diameters. There is a certain amount of variation in the dimensions of the feldspars in different specimens, but the above figures will give an idea of the scale on which they are commonly developed in those varieties which contain comparatively little interstitial matter.

When the powder of the rock, freed from the fine dust by washing, is placed in a diffusion-column of cadmium borotungstate, the feldspars form a fairly well-defined band, the centre of which corresponds to a specific gravity of 2.7. There is no great amount of scattering, and a fragment of labradorite floats in the centre of the band. The feldspar, therefore, agrees on the average with labradorite, but the optical characters of the zoned individuals, and the slight scattering of the grains in the diffusion-column, indicate deviations on both sides of the average. The central portions of the zoned individuals are more basic than the marginal portions, but the transition is not always continuous; so that in the life-history of individual crystals there has occasionally been a recurrence of the conditions which gave rise to the deposition of more basic material. The larger individuals frequently contain inclusions of brown glass, with or without bubbles. These inclusions are as a rule limited to the central portions.

Augite is abundant in all the rocks, and forms, with feldspar, the greater portion of the mass in the majority of cases. Generally only one type of augite is present. In thin sections this is pale brown, more rarely yellowish green, sometimes almost colourless. It is usually without any trace of crystalline form, and occurs as

grains or patches, which are often penetrated by the lath-shaped sections of plagioclase. As a rule, several individuals having different orientations occur in juxtaposition, so that the ophitic structure, though present, is not so marked as it is in many of the holocrystalline dolerites from Iceland, the Færøe Islands, and the West of Scotland. It resembles in character and mode of occurrence the augite of the Tynemouth and related dykes in the North of England.*

One rock-specimen, obtained from the underside of an iceberg found, tilted up, off Eira Cottage, which otherwise belongs to the common type, contains more or less idiomorphic phenocrysts of pale greenish augite, with peripheral inclusions, in addition to the ordinary augite above described. A few grains of this mineral were isolated, and the presence of chromium established. It is therefore, as was suspected from its appearance under the microscope, a chrome-diopside; and the fact is of some interest from the point of view of correlation, because Scharizer has proved the occurrence of this mineral under similar conditions in the basalts of Jan Mayen.† It will be shown subsequently that the basalts of Franz Josef Land have other points of resemblance with those of Jan Mayen.

The iron-ore occurs as grains, crystalline aggregates, and skeleton-crystals. It is strongly magnetic, and is often present in sufficient quantity to make the rock magnetic. The felspar and augite are as a rule remarkably free from inclusions of this mineral, which certainly does not in these rocks belong to the earlier phases of consolidation, as it does in so many rocks of intermediate composition. In many cases it is found only as skeleton-crystals in the interstitial matter, and in some the iron-oxides have remained wholly undifferentiated in a deep brown glass.

Olivine is by no means constantly present, and rarely occurs in sufficient quantity to give a marked character to the rocks. It occurs as grains, and occasionally as more or less idiomorphic crystals. When fresh it is colourless in the thin sections; but it

* "Petrological Notes on the North-of-England Dykes," "Quart. Journ. Geol. Soc." vol. xl. (1884) p. 209. See pl. xii. Fig. 6.

† "Ueber Mineralien u. Gesteine von Jan. Mayen," "Jahrb. d. k.-k. geol. Reichsanst." vol. xxxiv. (1884) p. 707.

is sometimes represented only by green, or more rarely by brown alteration-products. The occurrence of olivine in sparsely scattered grains or crystals seems to be a special character of this class of basalts. Its absence from any particular section does not prove that it is entirely absent from the rock, for if several sections be prepared from one specimen it may be found in some and not in others.

In addition to the mineralogical constituents above described, the rocks invariably contain a certain amount of interstitial matter, which assumes different forms in different cases. It may occur as a brown glass comparatively free from microlites, as palagonite arising from the alteration of this brown glass, or as a fine-grained matted aggregate of microlites of augite, magnetite, and felspar, with which some colourless base may possibly be associated. Transitions from the condition of brown glass to the microlitic type may sometimes be observed, and under these circumstances the gradual bleaching of the glass by the separation of ferriferous constituents is clearly shown. The amount of interstitial matter varies considerably in different specimens. It is very small in amount in the massive varieties, but in some of the vesicular forms it becomes an important constituent.

The most interesting type of interstitial matter is the palagonitic. Palagonite is especially abundant in the amygdaloidal varieties, where it occurs not only wedged in between the crystalline constituents, but also as the infilling material of some of the amygdaloids. It is a soft black or greenish-black substance, which can be readily scratched with the finger-nail and cut with a knife. The powder has a soft unctuous feel when rubbed between the fingers. Heated in a closed tube it gives off a large amount of water. It is readily acted upon by hydrochloric acid, and fragments leave behind a white siliceous pseudomorph. Under the microscope, in very thin sections, it is usually seen to be of a deep brown colour; but occasionally it contains green zones arranged parallel with the boundaries of the space which it occupies. In its general appearance, and in the presence of this zonal structure, it resembles the palagonite from deep-sea deposits described by Messrs. Murray and Renard.* When viewed with

* "Report on Deep-Sea Deposits," *Chall. Exp.* p. 304.

crossed nicols the palagonite is seen to be doubly-refracting. It appears to be formed of minute interlacing fibres or scales of a brown or, more rarely, of a green colour. The double refraction of the deep-brown palagonite enables us at once to distinguish it from the isotropic paler brown glass with which it is sometimes associated, and out of which it has been formed by hydration. The following analysis of this substance was made. Analyses of palagonite and of the closely-related "hullite" are quoted for comparison:—

	I.	II.	III.	IV.	V.
SiO ₂	35.48	41.26	44.73	46.76	39.44
Al ₂ O ₃	8.30	8.60	16.26	17.71	10.35
Fe ₂ O ₃	12.30	25.32	14.57	1.73	20.72
FeO	14.60	—	—	10.92	3.70
MnO	—	—	2.89	0.44	trace
CaO	1.04	5.59	1.88	11.56	4.48
MgO	7.10	4.84	2.23	10.37	7.47
Na ₂ O	3.92	1.06	4.50	1.83	—
K ₂ O	trace	.54	4.02	0.17	—
H ₂ O or loss on ignition .	16.80	12.79	9.56	—	13.62
	<u>99.54</u>	<u>100.00</u>	<u>100.64</u>	<u>101.49</u>	<u>99.78</u>

- I. From amygdules in basalt at Cape Flora, Franz Josef Land (Teall).
- II. Palagonite from Palagonia, Sicily. The insoluble residue (10.99 %) is deducted and the remainder calculated to 100. Quoted from Zirkel, "Lehrbuch der Petrographie," 2nd. ed. vol. iii. (1894) p. 689.
- III. Palagonite from South Pacific. Analysis by Sipöcz, *Challenger* "Report on Deep-Sea Deposits," p. 307.
- IV. Basic glass from the centre of the mass from which the palagonite (III) was obtained.
- V. "Hullite" from Carnmoney Hill, near Belfast. Analysis by Hardman. Quoted from Sollas and McHenry, "On a Volcanic Neck of Tertiary Age in Co. Galway," "Trans. Roy. Irish Acad." vol. xxx. (1896) p. 734.

The published analyses of palagonite differ considerably from each other, and the one which must now be added to the list does not entirely agree with any one of them. It is often stated that the iron present is wholly in the condition of ferric oxide. If this be taken as an essential character the present substance is certainly not palagonite, for most of the iron is in the ferrous condition. The discovery of so large an amount of ferrous oxide was quite unexpected, and a second determination was made with special care. The results in both cases were identical. It may, therefore,

be taken as certain that the present substance, which so closely resembles palagonite in its microscopic character, mode of occurrence, and relation to basic glass, is rich in ferrous oxide. As the other analyses differ widely in some respects, no great harm will be done by extending the use of the term so as to include this substance.

The "hullite" of Hardman has been shown by Profs. Cole* and Sollas† to occur, like the palagonite of Cape Flora, as interstitial matter, and as the infilling of amygdaloids. Mr. Hardman's analysis shows that the two substances have decided chemical affinities. Both are remarkable on account of the large amount of iron. Under these circumstances it became important to compare them as regards specific gravity. Mr. Hardman gives the specific gravity of hullite as 1.76, and Prof. Sollas confirms this somewhat extraordinary result. Five small pieces of palagonite were taken from two amygdules occurring in a specimen collected from the talus near Cape Flora, and placed in a solution of methylene iodide. After twenty-four hours' immersion it was found that two sank, one remained suspended, and two floated in a liquid of specific gravity 2.433; four sank and one remained suspended when the specific gravity of the liquid was lowered to 2.409. The specific gravity is therefore not constant, but it is somewhat greater than 2.4.

On comparing the analysis of the Cape Flora palagonite with that of Palagonia it will be noted that there is a close agreement so far as the total amount of iron is concerned, but an important difference as regards its state of oxidation. There are further important differences as regards the total amount of lime and the relative proportions of lime and magnesia.

The two analyses quoted from the *Challenger* Report are especially interesting. One represents the palagonitic crust, and the other the nucleus out of which it has been formed. They indicate, as the authors point out, that the change is accompanied by hydration, elimination of lime and magnesia, oxidation of the ferrous iron, and addition of alkalies.

* "On Hullite," Rep. Belfast Nat. Field Club, 1894-95, p. 1.

† "On a Volcanic Neck of Tertiary Age in Co. Galway," Sollas and McHenry, "Trans. Roy. Irish Acad." vol. xxx. (1896) p. 739.

More interesting results will be obtained if, instead of considering the palagonite of Cape Flora in relation to more or less allied substances from other localities, we consider it in relation to the rock in which it occurs. This is a basalt with a specific gravity of about 2.9. The palagonite has arisen from the hydration of the glass formed by the consolidation of the mother-liquor out of which the other constituents, mainly labradorite and augite, have crystallised. If we assume that the only chemical change which has taken place is that of hydration, then the percentage composition of the mother-liquor would be as follows:—

SiO ₂	.	.	.	.	.	42.88
Al ₂ O ₃	.	.	.	.	.	10.03
Fe ₂ O ₃	.	.	.	.	.	14.86
FeO	.	.	.	.	.	17.65
CaO	.	.	.	.	.	1.26
MgO	.	.	.	.	.	8.58
Na ₂ O	.	.	.	.	.	4.74
						<hr/>
						100.00
						<hr/>

In view of the researches of Lemberg* and the observations of Murray and Renard the above assumption is not warranted. Alkalies may have been added, and lime and magnesia removed. There is, however, no reason to believe that the relative amounts of alumina and iron have been appreciably changed, and we are therefore able to draw the important conclusion that in a magma of the type to which these basalts belong—that is, a basic magma poor in alkalies—progressive crystallisation leads to the formation of a mother-liquor poor in silica and alumina and rich in iron. It is possible that the relative amounts of lime and magnesia have not been seriously modified by the hydration, and if so we see that crystallisation may, at any rate in its earlier stages, tend to increase the relative amount of magnesia. The partial separation

* Lemberg examined the effect of water and solutions of alkaline carbonates on volcanic glasses. He says:—"Fassen wir alles zusammen, so werden basische Glaser (Palagonitglas, Tachylyt) schon durch reines Wasser hydratisirt; durch Alkalicarbonat werden auch saure Gläser sehr rasch umgewandelt; dabei wird Wasser aufgenommen, Alkali gegen andere starke Basen ausgetauscht, Kieselsäure zum Theil ausgeschieden" ("Zur Kenntniss der Bildung und Umwandlung von Silicaten," "Zeitschr. Deutsch. geol. Gesellsch." vol. xxxv. 1883, p. 557).

of the lime, alumina, and silica from the iron and magnesia is, of course, effected by the crystallisation of basic feldspars, which in this class of rocks precede the augites and sometimes even the olivine.*

This concentration of the iron, and to a certain extent magnesia, in the mother-liquor of basic magmas does not appear to have attracted the attention which it deserves. It shows that progressive crystallisation in these magmas sometimes leads to a result, the opposite of that observed in the case of intermediate magmas in which ferriferous compounds separate out during the early phases of consolidation.† The synthetic experiments of Messrs. Fouqué and Lévy‡ indicate that the formation of magnetite is not limited to one period in the history of the consolidation of silicate-solutions, and the same fact has been established by Vogt in his work on slags. The last-mentioned author has made a special study of the conditions under which magnetite is formed, and has established the fact that in basic slags in some cases magnetite precedes olivine; in other cases it crystallises simultaneously with olivine, and in yet others is formed after olivine.§

If we take the analysis quoted above, *minus* the water and alkali, as representing the composition of the mother-liquor formed after the separation of labradorite and augite, it is clear that we have still the material necessary to form olivine, magnetite, and spinel (hercynite).

In view of the evidence thus furnished of the concentration of iron, one is tempted to speculate as to the results that might follow if the process were carried still further. Magnetite forms the matrix of the cumberlandites of Rhode Island and Taberg, in which olivine and feldspar occur as phenocrysts.|| It is found as interstitial matter in the ultrabasic "schlieren" in the banded

* See W. W. Watts, "Guide to the Collections of Rocks and Fossils in the Museum of Science and Art," Dublin, 1895, p. 78.

† "On some Quartz-feldites and Augite-granites from the Cheviot-District," "Geol. Mag." 1885, p. 106.

‡ "Synthèse des Minéraux et des Roches," Paris, 1882.

§ "Beiträge zur Kenntniss der Gesetze der Mineralbildung in Schmelzmassen," "Archiv for Math. og Naturvidensk." Kristiania.

|| See "Lithological Studies," by M. E. Wadsworth, "Mem. Mus. Comp. Zool," Harvard, vol. xi.

gabbros of Druim an Eidhne.* Magnetite and a green spinel (hercynite?) are intimately associated in the pyroxenites from Scourie. Metallic iron associated with graphite occurs as interstitial matter in certain basalts in Greenland.†

Can it be that in some, at least, of these cases we see the extreme results of the process indicated above?

We have now described the principal constituents of the common type of basalt. The different specimens vary somewhat as to the relative proportions of the several constituents, and still more striking differences are due to the presence or absence of amygdaloids. The massive varieties are of medium grain, and contain comparatively little palagonite or other form of interstitial matter; the amygdaloidal varieties are usually of somewhat finer grain, and contain a considerable amount of palagonite. The labradorite formed first, and the larger individuals sometimes contain glass-inclusions in their central portions. The separation of labradorite probably left the mother-liquor poorer in alumina, lime and soda, and this facilitated the formation of augite. The common augite occurs in irregular grains and patches, which are often penetrated by the feldspars. The chrome-diopside belongs to an earlier phase of consolidation. Magnetite has formed at different stages, but it is commonly associated with the interstitial matter, and in many specimens the feldspar and augite are almost entirely free from inclusions of this mineral. The bulk of the magnetite belongs to a comparatively late period in the history of consolidation. Its distribution in the rock is in accordance with the view that progressive crystallisation has tended to concentrate the iron-oxides in the mother-liquor. In some specimens there is no recognisable magnetite, the whole of the iron-oxide, except that which occurs in the augite, remaining undifferentiated in the brown glass. Microscopic sections of the amygdaloidal varieties show the connection between the interstitial palagonite and that which

* "On the Banded Structure of some Tertiary Gabbros in the Isle of Skye," Geikie and Teall, "Quart. Journ. Geol. Soc." vol. 1. (1894) p. 645.

† "On the Existence of Nickel-iron . . . in the Basalt of North Greenland," K. J. V. Steenstrup, "Min. Mag." vol. vi. (1886) p. 1.

partially or wholly fills the vesicular cavities. There is perfect continuity between the two kinds. In cases of partial infilling the central portion of the cavity is occupied by calcite.

Many specimens of more or less decomposed basalt from the talus at Cape Flora contain beautiful, radiating, fibrous aggregates of natrolite, and the same mineral occurs in a more compact form in concentric concretions filling large, irregular cavities. It is found also in joints in rotten basalt. Analcime occurs in detached crystals, sometimes measuring more than 1 cm. in diameter, and also as aggregates of smaller crystals. The analcime of these rocks appears to be wholly of secondary origin, and does not occur as in the monchiquites and analcime-basalts.*

Agates are also represented in the collection, and one large specimen of chalcedony and quartz which was evidently formed in a hollow cavity measures about $20 \times 12 \times 10$ cms.

Calcite is abundant in the altered varieties, and frequently forms the infilling material of the amygdules, occurring either alone or in association with palagonite.

The specimens of basalt on which the above description is based were mainly collected near Cape Flora. The collection includes a few from Hooker Island which belong to the same type, but which are all massive.

Two or three points still remain uncertain with reference to the basaltic formations of Franz Josef Land. Judging from analogy with other districts of similar character, we should expect to find both lava-flows and intrusive sills. Tuffs and agglomerates are rare in regions of plateau-basalt, but they occasionally occur as necks and as beds interstratified between successive lava-flows. Then again old river-gravels and lake-deposits are sometimes found between the different outpourings of basalt.† Have we evidence of similar phenomena in Franz Josef Land? Unfortunately there is no petrographical character by which sills

* "On the Monchiquites or Analcite Group of Igneous Rocks," L. V. Pirsson "Journ. Geol. Chicago," vol. iv. (1896) p. 679.

† See Sir A. Geikie's paper on the "Tertiary Basalt-plateau of N. W. Europe," "Quart. Journ. Geol. Soc." vol. lii. (1896) p. 331. Future observers in Franz Josef Land would do well to study this paper.

can be in all cases distinguished from lavas in the Brito-Arctic province. The sills are usually coarser in grain, columnar, holo-crystalline, and ophitic in structure, but none of these characters can be relied upon as distinctive. Lavas are often amygdaloidal, but amygdaloids are not uncommon in sills and dykes.

We cannot, therefore, separate the specimens into two groups, lavas and intrusive sills. Nansen speaks of basalt interstratified with the underlying sediments, and the collection that we are describing contains specimens of amygdaloidal basalt "from lowest rock (six feet deep) having three feet layer of sandstone above it." They were collected from the watercourse running down the talus. It is a well-known fact that the basalts of the West of Scotland are often intercalated between Jurassic strata,* and this fact led the early observers to conclude that they were of Jurassic age; but it is now universally admitted that this intercalation is the result of intrusion along planes of bedding, and that the basalts in question are post-Cretaceous.

The existence of tuffs cannot be positively asserted from the evidence before us, but there are one or two specimens of highly altered rocks which may be tuffs. The evidence that pauses occurred during the formation of the plateau-basalts is of a more satisfactory character. This is furnished by a specimen of a conglomeratic rock, mainly composed of basaltic debris and containing rounded pebbles, "found in dolerite some fifty feet above lowest rock," near Cape Flora.

We are indebted to Mr. Fisher for the following table, giving the lowest level at which the main mass of basalt could be seen at several localities; the base, however, was often hidden by talus:—

	feet.
Cape Flora	600
Cape Gertrude	700
Cape Stephen	650
'Tween Rocks	450 at one place, 200 at another.
Cape Grant	400 to 500
Cape Crowther	700 on one side, and sea-level on the other.
Cape Neale	500

* Sir A. Geikie, *op. cit.* p. 375.

IV. DISTRIBUTION OF BASALTS OF SIMILAR TYPE.

We will now conclude this account of the ordinary basalts with some remarks on the general distribution of rocks of the same type. Specimens brought home by Payer were described by Professor Tschermak. He says: "It [the dolerite] is a medium-grained, dark yellowish-green, crystalline, massive rock. Plagioclase forms the principal mass, although it only exceeds the augite by a small amount. The crystals of plagioclase are frequently 1 mm., sometimes 3 mm. long. They consist sometimes of thin, and sometimes of thick, lamellæ. The augite is greenish-grey, shows no crystalline outlines, but forms grains which are often 1 mm. in diameter. Inclusions of the other minerals are frequent, and also gas-pores. Olivine forms grains which are smaller than the augite, and only seldom show crystalline faces. These grains are frequently surrounded with a border of a yellowish-brown mineral (eisenchlorit). The titaniferous iron-ore occurs in long plates or fills the space between the other minerals." The resemblance of this rock to the dolerites of Spitzbergen is pointed out, and it is also stated that "amygdaloidal varieties, so common in Greenland, were never found in Franz Josef Land; while the rocks in the south were aphanitic, and thus like true basalts, those in the north were coarse-grained and nepheline-bearing.* From this description we may conclude that the rocks brought home by Payer from the eastern portion of the archipelago resemble the massive olivine-bearing varieties of the Jackson-Harmsworth collection. Professor Tschermak makes no mention of the occurrence of palagonitic material as interstitial matter, but he refers to an iron-chlorite which he regards as arising from the alteration of olivine. It is possible that this substance may in part represent the palagonite so common in the rocks from Cape Flora. He speaks of the "titaniferous iron-ore" as "sometimes filling the space between the other minerals." The magnetite in the specimen that we examined contained only traces of titanitic acid, and in none of our rocks does it actually occur as interstitial matter. It either crystallises out during the later stages or else remains undifferentiated in the residual glass.

* "New Lands within the Arctic Circle," German ed. p. 267.

Specimens from the northern part of the archipelago have not as yet been examined in detail, but both Payer and Nansen agree that more coarsely crystalline varieties occur in this region. It would be interesting to know the exact nature of the evidence on which nepheline has been stated to occur.

The more or less allied rocks of Spitzbergen have been described by A. E. Nordenskjöld* as hyperite, and by Drasche† as diabase. They frequently occur as sills in rocks of very variable age. Both authors appear to regard them as contemporaneous with the strata in which they are found, and Drasche comments on the remarkable nature of the fact that rocks so uniform in character should be associated with strata of all ages from pre-Carboniferous to Tertiary. The remarkable nature of this fact disappears if we regard the rocks as intrusive sills.

A curious difference of opinion has arisen between Bäckström‡ and Nathorst§ as to these Spitzbergen rocks. At the conclusion of his paper on the liparites of Iceland, Bäckström calls attention to the widespread distribution of the basalts in the Arctic province which "extends on the one side to Spitzbergen and Franz Josef Land, on the other to Greenland, and in the south to Scotland." Nathorst, in commenting upon this statement, points out that basalt has not been found in Spitzbergen, but that post-Triassic diabases occur both as dykes and sheets (Decken). Whether the Spitzbergen rocks should be termed basalts or diabases is a matter of comparatively slight importance: it is certain, however, from Drasche's description that some of them are substantially identical with rocks described as basalt from other portions of the Brito-Arctic province. It is often not clearly recognised by Continental authors that the basalts and dolerites of this province are more closely allied in composition and structure to the pre-Tertiary diabases of the Continent than they are to the Tertiary basalts of the same region. We may

* "Sketch of the Geology of Spitzbergen," Stockholm, 1867.

† "Petrographisch-geologische Beobachtungen an der Westküste Spitzbergens," "Tscherm. Min. Mitth." 1874, p. 261.

‡ "Beiträge zur Kenntniss der islandischen Liparite," "Geol. Foren. Stock-Forhandl." vol. xiii. (1891) p. 671.

§ "Einiges über die Basalte des arktischen Gebietes," *ibid.* vol. xiv. (1892) p. 69.

safely conclude that the so-called "diabases" of Spitzbergen described by Drasche are of the same general character, and approximately of the same age, as the basalts of Franz Josef Land.

The rocks of Jan Mayen have been described by Reusch* and Scharizer.† The descriptions of these authors show that rocks closely allied to those of Franz Josef Land occur on this island. Thus Reusch speaks of the occurrence in one of the specimens examined by him of hollow cavities "encompassed by a zone of glass," and Scharizer records the presence of a chrome-diopside. In the British Isles the rocks which most closely resemble the vesicular basalts of Cape Flora are those of Carnmoney Hill, near Belfast, and of Bunowen Tower, in County Galway.‡ Both these rocks are ophitic dolerites which contain brown glass or its hydrated alteration-product (hullite). The rocks of the Tynemouth and related dykes also resemble the basalts of Franz Josef Land, but the interstitial matter which also occurs in some of the amygdules is always devitrified.

It is evident, therefore, that the basalts of Cape Flora and Hooker Island are similar types widely distributed in the Brito-Arctic volcanic province. They differ from the more common holocrystalline ophitic dolerites in containing a small quantity of interstitial matter. The general result of this examination is to confirm the conclusions of Payer, Etheridge, and others that Franz Josef Land belongs geologically to an extensive region of plateau-basalts, including such widely separated localities as Jan Mayen, Iceland, Greenland, the Færøe Islands, the West of Scotland, and the North of Ireland.

The second type of basalt is represented by some small angular fragments obtained from the underside of an iceberg in De Bruyne Sound. It differs from the common type above described, both in macroscopic and microscopic characters, and is, therefore, considered by itself. The rock is dark grey in colour, compact, and of so fine a grain that extremely thin

* "Det Norske Nordhavs-Expedition, 1876-1878," Christiania, 1882, p. 27.

† "Ueber Mineralien u. Gesteine von Jan Mayen," "Jahrb. d. k.-k. geol. Reichsanst." vol xxxiv. (1884) p. 707.

‡ See papers, already quoted, by Profs. Cole and Sollas.

sections and high powers are required to reveal its true character. The specific gravity is 2.977. The principal constituents are granules and microlites of augite ($.008$ mm. and $.008 \times .04$ mm.), microlites of feldspar ($.004 \times .04$), and crystals or grains of magnetite ($.008 \times .02$).^{*} It is possible that a small quantity of colourless interstitial matter (? analcime) may be present. The rock contains a few scattered feldspars, somewhat larger than the microlites, and also grains of quartz and patches of calcite. A special feature is the occurrence of aureoles of slender augite-microlites round some of the patches of quartz and calcite. These microlites are larger than those of the main mass of the rock, and show a rough tendency to a radial arrangement with reference to the nucleus.

The occurrence in basaltic rocks of quartz-grains surrounded by aureoles rich in augite-microlites has been frequently described,[†] and a discussion has arisen as to whether the quartz is indigenous or exotic. In this case the aureoles surrounding quartz are precisely similar to those surrounding calcite.

The microscopic action also shows many groupings of augite-microlites similar to those surrounding the grains of quartz and calcite, but without a central nucleus. This may be, and doubtless is in some cases, due to the fact that the section does not pass through the centre, but the occurrences appear to be too frequent to be entirely explained in this way. This type of basalt appears to be rare in the volcanic province to which Franz Josef Land belongs. We are unable to refer to any rocks from this province with which it can be said to be closely allied.

V. FOSSILS AND SEDIMENTARY ROCKS OF FRANZ JOSEF LAND.

The greater number of the fossils have been collected in the immediate neighbourhood of Elmwood, the depôt of the Jackson-Harmsworth party, and around Cape Flora; but others have

^{*} The figures are merely intended to give an idea of the scales on which the different constituents are developed.

[†] "On a Group of Volcanic Rocks from the Tewan Mountains, New Mexico, and on the Occurrence of Primary Quartz in certain Basalts," J. P. Iddings, "Bull. U.S. Geol. Surv." No. 66, 1890.

been obtained farther afield, during some of the longer expeditions. Each of the localities, with the fossils there found, will be first noticed, and their relations to each other afterwards considered.

The little settlement of Elmwood is on the south side of Cape Flora, on the island of Northbrook; it is placed on a raised beach at an elevation of about forty to fifty feet above the sea. Behind the settlement are extensive talus-heaps, above which steep cliffs rise to a height of about 1100 feet above the sea, and this is capped by 100 feet or more of ice. The lower 500 or 600 feet appears to be chiefly clay, interstratified with shales and bands of ironstone, lignite, &c., and almost hidden by the talus, while the upper 500 feet is basalt.

I. NORTH OF CAPE FLORA.

The highest fossiliferous bed said to be *in situ*, of which the collection has representatives, is that discovered by Dr. Koettlitz on the north side of Cape Flora, where a bed of shale, broken into innumerable fragments and containing impressions of plants, was found lying across a mass of dolerite, protruding through the west side of a glacier at a height of about 700 feet above the sea. This plant-bed therefore would seem to be included in the thickness of the basalt. A number of specimens were collected at this point by Dr. Koettlitz and subsequently by Dr. Nansen. The last-named gentleman submitted his collection to Dr. Nathorst, the well-known Scandinavian authority on fossil plants, and a very interesting account of them is given in Dr. Nansen's "Farthest North,"* together with some woodcuts of certain of the specimens. According to Dr. Nathorst the most abundant remains were needles and seeds of coniferous plants, which he refers to *Pinus* and *Taxites*; but the most interesting among his specimens are leaves of the genus *Ginkgo*, only one species of which is now living—in Japan. This genus, however, is very characteristic of certain Oolitic deposits in Europe, and several species have been found in the Jurassic, Cretaceous and Tertiary strata of Spitzbergen, Greenland, and Eastern Siberia. One of the

* Vol. ii. p. 484.

forms from Franz Josef Land is believed by Dr. Nathorst to be a new species, for which he proposes the name of *Ginkgo polaris*. It is said to be a near ally of *G. flabellata* from the Jurassic of Siberia and is not unlike the *G. digitata* from British Oolitic strata.

A few ferns were included in Dr. Nansen's collection, and these are said to represent four types, but to be too imperfect for specific determination. One of these is referred to the genus *Cladophlebis*; two others are said to suggest the genera *Thyrsopteris* and *Onychiopsis*, while the fourth seems closely allied to *Asplenium petruschinense*, described by Heer from Jurassic strata in Siberia.

PLANTS IDENTIFIED BY DR. NATHORST.

Pinus like *Nordenskioldi*, but probably another species.

.. species with narrow needles.

.. seeds, resembling those of *Maakiana*.

Taxites nearest to *T. gramineus*, Heer.

Feildenia (= *Torellia*) sp.

Ginkgo polaris, Nath.

.. sp.

Czekanowskia.

Cladophlebis.

Thyrsopteris?

Onychiopsis?

Asplenium near to *A. petruschinense*.

A goodly number of examples of these plant-impressions collected by Dr. Koettlitz have been sent home, and although small and fragmentary, as indeed were all the specimens found at this locality, they represent most of the forms mentioned by Dr. Nathorst. There are many of the winged seeds of *Pinus*, varying in form, and possibly representing more than one of the species alluded to in the above list. With these are numerous pine-needles, both broad and narrow, as well as a portion of a branch and a small cone. A few fragments may belong to the genus *Feildenia* [*Torellia*]. The peculiar form *Ginkgo* is represented by many specimens, some of which are referred to Dr. Nathorst's new species, *G. polaris*; but there are others rather larger, with more slender divisions to the leaves, and with seven or eight ribs on each blade, which are very like *G. siberica*, Heer, if they are not identical with that species.

Ferns are represented by several specimens which, although

small, are well preserved, and in some the venation of the pinnules is particularly well shown. There is some variation in the form of the pinnules of these specimens, but this is not greater than might be expected in different individual plants, or perhaps even in parts of the same frond. The only genus mentioned by Dr. Nathorst to which these could belong is *Thyrsopteris*, and there is much resemblance between the present specimens and *Th. Murrayana* and *Th. Maakiana*,* which occur in the Jurassic rocks of Eastern Siberia and of England.

The pinnules of these ferns also bear much resemblance to the figures of *Adiantites amurensis* as given by Heer,† but it seems best, for the present, to leave them in the genus *Thyrsopteris*. In none of these forms, however, is the venation so clearly shown as it is in some of the Franz Josef Land specimens, and in the latter also the bifurcation of the veins in the pinnules seems to be more regular and definite.

Dr. Nathorst found no cycads among his specimens; there are however, in our series one or two long lanceolate leaves, not quite perfect, which so closely resemble some of those that have been called *Podozamites lanceolatus* that they are provisionally referred to that species.

We have a few examples of long, slender, regularly-tapering leaves (?), with few strongly-marked longitudinal ridges; these are broken across in such a way as to resemble a jointed stem, and remind one of a slender *Equisetum*. The true affinities of these specimens are not clear, but they bear some resemblance to *Baiera* and *Czekanowskia*.

With regard to the probable geological age of these plants, we could not do better than quote the opinion of Dr. Nathorst; but, as we are not permitted to do so, we can only refer our readers to "Farthest North" (p. 487), and say that on the whole this flora resembles that of the Upper Jurassic beds of Spitzbergen, and indicates a cool climate, but one much more genial than that which obtains in Franz Josef Land at the present day.‡

* Heer, "Flora Fossilis Arctica," vol. iv. "Beiträge zur Juraflora Ost-Sibriens, &c.," pl. i.

† *Ibid.* pl. xxi. fig. 6.

‡ This plant bed was subsequently found at other places around Cape Flora. See "Quart. Journ. Geol. Soc." vol. liv. (1898) p. 648.

2. EAST OF ELMWOOD.

The second set of specimens to be noticed are labelled "East Elmwood and above Sharp's Rock." These are specimens of some thin beds of shale which were found exposed *in situ* just below the basalt, but in which no fossils were found. Taken in descending order, these are:—

(i) Black shale 4 inches thick, from just below the basalt. There is no appearance of this shale having been heated to any extent by contact with the basalt.

(ii) Black material like the preceding, but broken into fine particles and powder, $1\frac{1}{2}$ inch thick.

(iii) Greenish-grey shale, 3 inches thick.

(iv) A lighter-coloured brownish clay-shale, the thickness of which is not recorded.

Near this same spot, at the base of the second tier of basalt, a part of a tree trunk was found embedded in the rock; it measures 2 feet long, and is about 40 inches in circumference. The wood is partly silicified, but some portions appear to be preserved in carbonates of lime and iron.

3. ELMWOOD.

In a watercourse at the back of Elmwood the rock is uncovered at a point 50 feet below the basalt, and from this exposure of "clay-sandstone" a small, well-preserved ammonite was obtained.

Unfortunately this ammonite is the only specimen which was found in place at this spot, but in the same watercourse below the exposure of rock, and apparently fallen from the rocks above, a number of other specimens were collected, chiefly in blocks of clay-ironstone. Among these are ammonites identical with that found in place, as well as others which are referable to *A. macrocephalus* and *A. modiolaris*.

The number of species found at this locality is not great, and they will now be considered in detail.

AMMONITES (CADO CERAS) TCHEFKINI ?, d'Orb.—To this species is referred provisionally the one ammonite found *in situ* 50 feet below the basalt at Elmwood, as well as several other specimens

found in the watercourse below this exposure and two others from the side of the glacier at the western end of Cape Flora.

The ammonite found *in situ* is about 22 mm. in diameter, and 7 mm. thick; the umbilicus is 6 mm. in diameter. The ribs are sharply defined and regular in thickness, having no enlargements or tubercles; they pass outwards from the umbilicus, and in most cases bifurcate about the middle of the side, then with a definite flexure forwards pass over the back, which is narrow but not sharp. Most of the other specimens above noted agree so closely with the one just described as to need no further mention, but one of them is nearly twice the size (35 mm.) and shows that the forward flexure of the ribs becomes less marked as the shell grows larger. The outer part of this specimen is crushed, so that its form is uncertain.

On comparing these ammonites with young examples of *A. Tchefkini* from Russia their agreement is found to be so close that, for the present, they are referred to that species; but at the same time there are small points of difference which leave some doubt. None of the Franz Josef Land specimens are large enough to show signs of the lateral expansion which characterises the adult *A. Tchefkini*, but the largest of them retains the same character of the ribs on the outer whorls that it has on the inner whorls—that is to say, the ribs merely bifurcate, and consequently those around the umbilicus are of the same size as those near the back. Now, in all the larger specimens of *A. Tchefkini* available for comparison, the ribs around the umbilicus are distinctly larger than those on the back, and only one third or perhaps one fourth as numerous. The figures of *A. Tchefkini* given by De Verneuil* and Nikitin† show this same character.

In the Museum of Practical Geology there are several specimens from the Kellaways Rock of Chippenham which come very near to the Arctic ammonites, and these have been regarded as a variety of *A. Mariæ*.

AMMONITES (CADCERAS) MODIOLARIS, Luid. — The specimens from this locality referred to the above species are two fragments of whorls, which show the lobes and saddles very clearly, and

* "Géologie de la Russie d'Europe," vol. ii. (1845) pl. xxxv.

† "Mém. Acad. Imp. Sci." St. Petersburg, ser. 7, vol. xxviii. (1881) No. 5, pl. iii.

in form and markings agree closely with examples of *A. modiolaris* from the Kellaways Rock. A cast from the umbilicus of one of these fossils also agrees with this species, and there is a similar cast from the talus of the western end of Cape Flora which just fits the umbilicus of one of the Kellaways Rock specimens in the Museum of Practical Geology.

One specimen from the talus near Elmwood embedded in ironstone and partly crushed, so as to give the appearance of a sharp back, has a much wider umbilicus than is usual in *A. modiolaris*; but as this agrees with the figures given by Professor S. Nikitin of a specimen from Elatma,* which is regarded as *A. modiolaris*, the Cape Flora specimen is likewise referred to this species.

Another specimen, from below where the rock was found *in situ*, is more compressed, and in this respect somewhat resembles *A. Elatmæ*;† but, while the ribs are quite as strong as in the latter species, there is no evidence of the large tubercles around the umbilicus.

A better-preserved example of this variety was obtained from the side of the glacier at the west point of Cape Flora.

AMMONITES (MACROCEPHALITES) MACROCEPHALUS, Schloth.—The specimens from the present locality referred to this species are not good, but a much better example is that received in the earlier consignment and noted by Mr. G. Sharman in the "Geographical Journal,"‡ a further examination of which has convinced us that it is true *A. macrocephalus*. In these specimens the ribs pass directly outward from the small umbilicus, and, after bifurcating, run over the back without any forward flexure; they agree with British and Continental examples of this species, and attention may be especially directed to Professor Nikitin's § figures of specimens from Kellaways beds near Elatma, in Central Russia.

Another specimen found upon the talus heap, which includes about half the shell, has rather more rounded whorls; but, as it resembles some of the inflated forms which have been referred to *A. macrocephalus*, it is provisionally allowed to remain here.

* "Nouv. Mém. Soc. Imp. Nat." Moscou, vol. xv. (1885) pl. xi. fig. 48.

† Nikitin, *op cit.* vol. xiv. (1881) pl. xi. fig. 21.

‡ Vol. vi. (1895) p. 518.

§ "Nouv. Mém. Soc. Imp. Nat." Moscou, vol. xv. (1885) pl. viii. fig. 44.

BELEMNITES PANDERI, d'Orb.—Fragments of several belemnites have been collected at No. 3 locality, but only a few of them can be determined with certainty; on comparing them, however, with better fragments from the talus there is no doubt as to their being the same species. These belemnites belong to the group in which the radiation, seen on the cross-section of the guard, is excentric, as in the well-known *B. lateralis*. In the specimen now under consideration the guard is not flattened dorso-ventrally, as in the last-named species, but to a slight extent laterally, and there is a distinct though not very deep ventral groove near the apex, and extending a short distance along the guard. The most perfect specimen was found on the talus at the western end of Cape Flora: it is only about two inches long, and shows nothing of the alveolar cavity. Other examples retaining this cavity show that it is excentric.

A comparison of these belemnites with a series from Russia, in the possession of Mr. Lamplugh and named by Professor Alexis Pavlow, left no doubt as to their agreement with examples of *B. Panderi*, a species which has been recorded from the Middle Kellaways and passes upward to the Kimeridge Clay.*

PECTEN *cf.* DEMISSUS.—The mould of a small *Pecten* evidently indicates a shell closely allied to, if not identical with, the common Oolitic *Pecten demissus*, which is one of the species recognised in the Upper Jurassic rocks of Spitzbergen.

GORGONIA (?).—On one of the ironstone-blocks is to be seen a long cylindrical body, about 1 mm. in diameter and 70 mm. long, the nature of which is by no means clear. Only part of this now remains, and it seems to be entirely replaced by iron pyrites. Externally it is almost smooth, with a few transverse, very fine lines. This fossil calls to mind the rod of the living *Pennatula* and that of the *Graphularia* from the London Clay; but it is not now a continuous rod: there are regular intervals here and there, reminding one of the interrupted condition of the stem in the genus *Isis* and its allies. These intervals may, however, be due to breakage before being embedded in the rock.

PHOSPHATIC NODULES.—Rounded and ovoid nodules of a

* S. Nikitin, "Ueber die Beziehungen zwischen der russischen u. der. west-europäischen Juraformation," "Neues Jahrb." vol. ii. (1886) p. 205.

pale brown colour externally, but black or dark brown internally, occur with these fossils, and apparently at almost all the horizons from which fossils have been collected; mostly they seem to have been free in the clay, but sometimes they are included in the clay-ironstone. These nodules vary much in size, some being less than an inch in diameter, others three or four inches in length and perhaps two inches in diameter. Thin sections under the microscope show, for the most part, a mass of fine débris with nothing definable; but some specimens show in parts small masses of minute oval bodies, with a long diameter of 1 mm., which agree in form and size with the small coprolites described by Mr. A. Strahan* from the Phosphatic Chalk of Taplow, and indeed there can be little doubt that they are the droppings of some small animals. And further, upon closer examination with the microscope these minute ovoid bodies may be seen pressed closer and closer together until at last they form one mass; but in most cases the separate pellets may be still distinguished. A number of these nodules have been tested, and in all cases they proved to be rich in tricalcic phosphate.

The following forms have been identified from this horizon at locality No. 3:—

Ammonites (Macrocephalites) macrocephalus.
 „ (Cadoceras) *Tchefkini* ?
 „ „ *modiolaris.*
 „ „ „ var.
Belemnites Panderi.
Pecten cf. demissus.
Gorgonia ?
 Phosphatic nodules.

Precisely similar forms have been found in the talus at other points near Elmwood, and on the side of a glacier slope at the western point of Cape Flora.

This series of fossils, although small, is of the greatest interest, inasmuch as it contains ammonites which give no uncertain indication of the horizon to which they must be referred. *Ammonites modiolaris* is distinctly a Kellaways Rock form, although extending into the true Oxford Clay. The occurrence with this of *A. macrocephalus*, which not only occurs in the lowest Oxford

* "Quart Journ. Geol. Soc." vol. xlvii. (1891) p. 356.

Clay and Kellaways Rock, but is perhaps the most characteristic ammonite of the Cornbrash, shows very clearly that beds of lowest Oxfordian age occur at Cape Flora at a height of about four hundred or five hundred feet above the sea, and doubtless correspond to some extent with the "*macrocephalus*-beds" which are now known to have so vast an extent throughout the northern hemisphere, if, indeed, they do not also occur in Australia.

4. WINDY GULLY.

The next exposure of rock to be noticed is that which was found at the southern end of Windy Gully, a valley north-east of Elmwood, running nearly north and south. Near the southern end of this valley there is a projecting shoulder of rock, and on this, at a height above the sea of about three hundred feet,* a number of fossils were obtained, nearly all of them being in hard concretions or in phosphatic nodules. Dr. Koettlitz is satisfied that they were *in situ*; but even if not actually in place, they could only have been weathered out of the rock on which they rested.

These beds seem to be lower in the series than those of No. 3, unless the strata are less horizontal than we understand them to be, and they have yielded a different set of fossils; the most striking of these are some ammonites which are believed to be varieties of *A. Ishmæ*, a species described by Keyserling from Ishma in Petchora Land.

AMMONITES (MACROCEPHALITES) ISHMÆ, Keys., var. ARCTICUS. —Several examples of this ammonite were found, but they vary somewhat in form. The most typical specimen is also the most perfect; it is about $2\frac{3}{4}$ inches in diameter, and its greatest thickness measures $1\frac{1}{2}$ inch. The ribs, which are sharply defined, pass outwards, with a distinct inclination forwards. At a distance from the umbilicus of about one-third the height of the whorl, the ribs bifurcate, and then pass over the back. Occasionally there is a single rib interposed. The umbilicus is very small, less indeed than is usually the case in *A. macrocephalus*, although it is equally small in some specimens that

* [Dr. Koettlitz says "over 400 feet."]

have been referred to the latter species. In nearly all the above points our specimen resembles *A. macrocephalus*, but on closer examination it is found that the whorls do not increase so rapidly; and as at the same time they are more involute, the outer whorls are much more encroached upon by the whorl which precedes it; so that while in *A. macrocephalus* the last whorl is encroached upon for less than half its height, in the present form the encroachment is always more than half the height, thus indicating a different mode of growth. And further, the sides of this species are less inflated around the umbilicus, and more so towards the back; so that the entire shell has a different aspect.

If this specimen be compared with Keyserling's figure of *A. Ishmæ* from Petchora Land,* it will be seen that in most of those points in which our specimen differs from *A. macrocephalus* it approaches *A. Ishmæ*; but at the same time the inner whorl of *Ishmæ* does not encroach so much upon the outer one as is the case in the Arctic specimen. This encroachment of the whorls, involving, as it does, a different growth of the shell, may perhaps be thought sufficient for the establishment of a new species, and if so the name of *A. arcticus* may be used; but it has seemed better for the present to include this form in the species *A. Ishmæ*, and call it a variety—*arcticus*.

Among the ammonites collected from this locality there are two others which agree with the one described, but are less perfect; besides these are two which, agreeing with the type in all main particulars, differ in being more inflated, and one of them has coarser ribs. Still another specimen, showing all the characters of the type, has the outer whorl nearly smooth, although it is a rather smaller shell. The specimen above described, however, shows the beginning of this smooth outer whorl, but it must have been a considerably larger individual.

BELEMNITES sp.—A number of portions of belemnites were found at this locality, but none of them are perfect enough for specific determination. Two of these are phragmocones of some large species, contained in nodules. Another specimen gives evidence of a long slender form, apparently circular in section and

* "Reise in das Petschora-Land," 1846, p. 331, pl. xx. figs. 8 and 9.

concentrically radiated. This belemnite is preserved in a block of ironstone, and possibly belongs to another bed.

The remainder of the specimens are much decomposed; some of them seem to have been compressed laterally, and to show a deep ventral groove. One specimen is a short form, with the alveolar cavity seemingly reaching to near the apex.

Although it is tolerably clear that these *Belemnites* represent at least three species, yet there is no evidence of an excentric form which could be referred to *B. Panderi*.

Phosphatic nodules occur.

LIST OF FOSSILS FROM WINDY GULLY.

Ammonites (*Macrocephalites*) *Ishmae*, var. *arcticus*.
 " " " inflated variety.
 " " " smooth variety.
Inoceramus, large form resembling *I. Cuvieri*.
Belemnites. 3 species.
 Phosphatic nodules.

Although it is clear, from their relative height above the sea, that these fossils occupy a lower horizon than the bed with *A. macrocephalus* and *A. modiolaris*, yet the fossils themselves give no evidence that such is the case; and it is quite possible that they may belong to the lower Oxfordian. It seems likely, however, that being 150, or perhaps 250 feet, lower in the series of beds, and the fossils of a different type, they represent a somewhat lower horizon and may perhaps be more nearly of the age of the Cornbrash.

5. WEST OF ELMWOOD.

At a spot about five hundred yards west of Elmwood, and some thirty or forty feet above the sea, "sandy shale" was found *in situ*, and from this were collected a number of fragmentary fossils which had been washed out from the rock. These fossils are mostly either pieces of belemnites or parts of a large species of *Avicula*, but there is one fragment of an ammonite allied to *A. Gowerianus*, which is as yet undetermined.

BELEMNITES sp.—Most of the fragments of belemnites from this locality are so much broken and decomposed that it is hope-

less to think of specific determination; nevertheless, there are a few points which may be noticed. There are evidently two, if not three, forms; but none of them can be referred to *B. Panderi*, as they do not show the marked excentric radiation of the transverse section characteristic of that species. One form is compressed, with a well-marked groove near the apex and a slightly excentric radiation.

A second form is similar, but much more compressed, and there seems to have been a deep groove extending from the apex some distance up the guard.

The third form is cylindrical, concentrically radiated, and with a comparatively acute apex.

Some of these belemnites may be the same as those from locality 4.

AVICULA sp. cf. INÆQUIVALVIS.—There are several of these large aviculas, but all are more or less crushed and broken. Some of them, probably on account of breakage, look more equilateral than others, and at first sight remind one of *Pecten*; but the large wing on one side shows that they do not belong to that genus.

The best preserved specimen in its present condition is $1\frac{3}{4}$ inch in length; but, with the exception of the umbo and a piece of the hinge, all the margins are broken away, and, judging from other fragments, the species must have reached three or four inches in diameter. One valve is moderately convex, while the opposite valve is concave. Strong ribs radiate from the umbo to the margin; between these are finer ribs, and a third still smaller series are to be seen between each of these, giving the shell much the appearance of a well-marked *A. inæquivalvis*, but in that species the ribs are not nearly so strong. The concave valve is less distinctly marked than the other. The hinge is long, and the posterior wing is much larger than the anterior. Some of the specimens appear to be more equilateral than others, but this is believed to be due to crushing; and as all have similar markings, they are regarded as one species.

The small height above the sea at which this exposure of rock is situated, to the west of Elmwood, shows that it occupies a position at about two hundred and fifty feet below the bed with

Ammonites Ishmae var. *arcticus* at Windy Gully, but the specimens give no idea of their age.

6. CAPE GERTRUDE.

Cape Gertrude, which is some two or three miles east of Cape Flora, rises to a height of about 1100 feet above the sea. Mr. Fisher, who has carefully examined this locality, says that the uppermost 100 feet is basalt, columnar above, but more irregular underneath. From the base of this basalt to the sea-level the face of the cliff is almost hidden by talus; but at one place the débris has been cleared away, apparently by ice or rock falling from above, exposing a series of sedimentary beds more than 200 feet high by about 100 feet wide, the lowest part being between 300 and 400 feet above the sea. Dr. Koettlitz, with Mr. Fisher, measured the section thus exposed, and they found as many as seventy beds of sand, flaggy sandstone, pebbly sand, shales, lignite, &c., varying in thickness from 3 inches to 25 feet. The extraordinary number of thin beds of diverse character shown in this section points to rapidly-varying conditions of deposition, and possibly to oscillations of level; while the beds of lignite indicate, to some extent at least, a freshwater origin.

With the exception of this lignite, and some wood found embedded in the lower part of the basalt, no fossils have been obtained from this section, and consequently the beds cannot be correlated with those at Cape Flora. The lignite-seams at the latter locality, and the few indications there seen of the nature of the beds, appear to indicate many rapid alternations of thin beds, similar to these at Cape Gertrude; and, judging from this and the height of the beds above the sea, it is likely that the Cape Gertrude section corresponds to part of the Jurassic series present at Cape Flora.

Much interest attaches to the discovery above mentioned of the masses of wood in the lower part of the basalt; for Mr. Fisher says that it is of precisely the same character as the silicified wood which has been found so abundantly on the talus at Cape Flora and also at Cape Gertrude; but this is the one place where it has been found *in situ*, and is the only clue that we at present possess as to its place of origin.

7. CAPE STEPHEN.

We have now to travel some twenty miles west of Cape Flora to Cape Stephen. Both at this point, and also between here and Cape Grant, a hard calcareous sandstone was met with, near the sea-level and under the raised beach. This bed, which is *in situ*, contains an abundance of carbonised plant-remains, but they are not well preserved, and in none of them can the details of structure be seen. Consequently their determination cannot be settled with that degree of certainty which could be wished. Although the stems of Equisetaceæ and some other forms are not unlike species with which we are familiar in the Yorkshire Lower Oolites, yet these Arctic specimens seem to agree best with the flora described by Professor Schmalhausen from Petchora and Tunguska.*

PHYLLOTHECA (EQUISETITES), *cf.* COLUMNARIS, Phil.—Several striated and jointed stems, such as we have long known under the name of *Equisetum columnare* in the Yorkshire beds, occur in these sandy deposits at Cape Stephen. These stems vary from $\frac{1}{4}$ to perhaps $1\frac{1}{2}$ inch in diameter. In two instances, what looks like an outer sheath of a joint is preserved, showing at one end the oval spaces to which the whorl of spikelets or perhaps branches was attached. There is also one portion of a "disc" with the spikelets still attached.

RHIPTOZAMITES? *cf.* GÆPPERTI, Schmalh.—The cycadaceous leaves of various shapes and sizes from Northern Siberia which are referred by Professor Schmalhausen to the above genus and species seem to find their counterparts among the plant-remains on these slabs from Cape Stephen. Some of these leaves are slender and lanceolate, others broader and more oval, but each leaf, as far as can be seen, has fine ribs running nearly parallel from end to end. A portion of what may be a large oval woody leaf of this form, in its present broken condition, measures nearly 2 inches in width.

ANOMOZAMITES?—A fragment of what appears to have been a large leaf of a Cycad allied to *Anomozamites* shows what seems to be a broad midrib and on one side three unequally

* "Mém. Acad. Imp. St. Pétersb." ser. 7, vol. xxvii. (1880) No. 4.

divided portions of the leaf, thus resembling the genus *Anomozamites*; it is introduced here for the sake of calling attention to the possible presence of this genus, but the specimen is not sufficient for certain identification.

ZAMIOPTERIS? *cf.* *GLOSSOPTEROIDES*, Schmalh.—There are a number of more or less fragmentary leaves to be seen on these slabs, which, while varying in size, agree in being broadly lanceolate and in having a venation which passes obliquely outwards from the middle line forward to the periphery, but without a definite midrib. The venation of these leaves certainly appears coarser than those shown in the figures given by Schmalhausen, but as it is possible that this may be due to their bad state of preservation, I have provisionally referred them to *Zamiopteris*.*

ASPLENIUM cf. *WHITBIENSE*, Brongn.—A portion of the frond of a fern with pinnulæ short and pointed, with entire margins and with a base attached by its whole width, is generally believed to represent the species, which, besides its original home, the Yorkshire Oolites, is said to occur in the north of Siberia. The venation of the Franz Josef Land specimen is entirely obliterated, and consequently the determination can be regarded as only doubtfully correct.

LIST OF FOSSILS FROM CAPE STEPHEN.

Phyllothea cf. columnaris, Phil.
Rhiptozamites ? cf. Gæpperti.
Anomozamites ?
Zamiopteris cf. glossopteroides.
Asplenium cf. whitbiense.
 Bituminous shale.

The striking resemblance between this series of plant-remains from near Cape Stephen, and those described and figured by Professor Schmalhausen from Lower Tunguska, can only lead to the inference that they are approximately of the same age. This Tunguska flora was at one time supposed to be Palæozoic,

* Compare also with *Gangamopteris*. See Seward, "Quart. Journ. Geol. Soc." vol. liii. (1897) p. 324.

but Professor Schmalhausen afterwards regarded it as of Oolitic age, and even referred it to the great Oolite.*

There is no stratigraphical evidence available which might indicate the position of these plant-beds at Cape Stephen, and the distance between them and Cape Flora prevents any correlation with the strata there exposed, as we know nothing of the possibilities of the change of dip or faulting which may occur in the twenty miles which intervene. At the same time it may be remembered that the probable north-easterly dip of the beds in Franz Josef Land would, if correct, bring these beds some little distance below horizon No. 5 at Cape Flora, where indeed beds of Lower Oolite age might be expected to occur.

Bituminous paper-shales occur in close relation with these sandstone plant-beds at the locality between Cape Stephen and Cape Grant, sometimes called "Tween Rocks," but it is not known whether they are merely in restricted patches or occur as regular beds. This shale contains a large amount of combustible matter, and burns with a good flame.

Near the spot at "Tween Rocks" where the plant-bed was found, a bed of coaly lignite was discovered at a height of about 300 feet above the sea; this, Mr. Fisher tells us, was undoubtedly *in situ*. A stream of water had cut a channel for itself in the almost perpendicular cliff and had exposed this stratum, a good-sized block of which has been sent home, but is now split into many pieces, a consequence, probably, of its having been frozen. This coal burns with a good flame, and was recognised by the discoverers as a possible supply of fuel; it is not merely a lignitised tree-stem, but is composed of crushed and compacted vegetable matter. One point of interest about this coal is that in part macrospores can be seen with a lens, reminding one of the "spore coal" so commonly met with in "Coal Measure" coal;

* [Mr. Seward, in the "Quart. Journ. Geol. Soc." (vol. liii. 1897, p. 325), says that the rocks described by Schmalhausen are probably of Permian age (see Zeiller, "Bull. Soc. géol." France, ser. 3, vol. xxiv. 1896, p. 466). If this be so, then the series of plant-remains from Cape Stephen, which are so similar to those from the Tunguska deposits, may prove to be of the same age. But an Oolitic facies in the case of Permo-Carboniferous plants is so remarkable that, in the absence of some characteristic form, such as the *Sigiliaria* described by Mr. Seward from the South African beds, it would hardly be safe to regard these Cape Stephen plant-beds as of Permian age.]

and on examination with the microscope this portion of the lignite was found to be largely made up of micro- and macrospores.

This coal-seam, so far as we can judge, occurs about 300 feet above the sandstone which has yielded the plant-remains, and it may be that it belongs to beds of about the same period. A similar lignite or coal was found on the moraine at Cape Richthofen, but it is not certain that it contains macrospores.

There is still a specimen from Cape Stephen which has to be noticed; but, as it was obtained from the talus at 300 feet above the sea, it is evident that it must have been derived from a bed situated at that or some greater elevation. The specimen is a slab about 10 inches square and $1\frac{1}{2}$ inch thick, wholly composed of layers of plant-remains completely silicified; it is black throughout, but one surface is weathered white. The greater part of the plants are strap-like leaves from 4 to 9 mm. wide, and the longest piece measures about 110 mm., but none are perfect at the ends; the broadest leaf has eleven longitudinal ridges. They remind one of *Baiera* and *Podosamites*, but there is no evidence of their mode of attachment, and their true affinities are uncertain.

On this slab there is a fan-like leaf which is believed to be an undivided *Ginkgo*-leaf, like that of *G. integriuscula* from Jurassic beds in Spitzbergen,* but it has a still closer resemblance to *G. reniformis*, Heer, from Tertiary beds on the Lena.† As the identity of this *Ginkgo* is not established, it can only be taken as an indication of the possibility of the specimen being of Tertiary age, and the other plants on the slab do not seem to militate against this; the piece of a conifer-branch close to the *Ginkgo* might be of almost any age. It is quite possible, on the other hand, that this slab has been derived from a bed representing at Cape Stephen the Upper Jurassic plant-bed of Cape Flora. Finally, it may be that this silicified slab is of the same age as the silicified wood which is so abundant in Franz Josef Land; but the age of the wood is yet to be settled.

* Heer, "Flora Fossilis Arctica," vol. iv. (1877) pt. i. p. 44 and pl. x. figs. 7-9.

† *Ibid.* vol. v. (1878) pt. ii. p. 32 and pl. viii. figs. 24-25.

8. CAPE CROWTHER.

Cape Crowther, which is twelve miles north west of Cape Grant, has been visited, but the only specimens that we have received from that locality are a piece of the ubiquitous silicified wood, a mass of silicified plant-remains, and some black-banded chert containing vegetable tissue. These fossils were not found in place, but were picked up from the highest raised beach.

9. CAPE NEALE.

About six miles still farther north-west is Cape Neale, the most westerly point from which we have received specimens. On the summit of this headland, which reaches a height of 700 feet, there is a level plateau free from snow, and from here we have received some silicified wood which is stated to be part of a large black block found protruding from the soil. With this wood were some black flinty specimens containing plant-remains and likewise fragments of what looks like siliceous sinter. The upper 250 feet of Cape Neale is formed by basalt, and it was on this that the fossil was found.

10. HOOKER ISLAND.

Hooker Island, which lies about 20 miles north-east of Northbrook, has been visited by Mr. Jackson with some of his party, and on the higher raised beach, as Mr. Fisher tells us, several small flints and cherty specimens were obtained from the "soil," which soil is formed of disintegrated basalt. The flints and cherty specimens all seem to contain traces of vegetable tissue, but this is very indistinct.

11. CAPE RICHTHOFEN.

During Mr. Jackson's journey to the north a number of specimens were collected and labelled $80^{\circ} 51' N.$ and $53^{\circ} 40' E.$, which, according to the map, seems to be at or near Cape Richthofen. The specimens were found on the top of a lateral moraine which is said to be 300 feet high and 500 yards wide, but the height above the sea is not stated. The specimens are fragments of basalt, rotten vesicular basalt, brown sandstone, cherty nodules, lignite, friable sandy shale with plant-remains, and a small mass

of compressed vegetable remains. About some of these a few words may be said, but it is unfortunate that they were not *in situ*.

One of the nodules (No. 345) is a grey-and-white cherty flint, which under the microscope is seen to be chalcedonic and contains some indistinct foraminifera which remind one of *Rotalia*, but they are not sufficient for determination and give no clue as to age. The latter remark may be also applied to the large sponge-spicules seen in a second cherty nodule, which looks like one of the "glass-rope" sponges.

Two of the pieces of lignite are really pieces of tree-stems or branches retaining the outward form, but they are so much altered and in so friable a condition that their microscopic structure has largely been obliterated. It is not quite certain what the wood is, but an appearance which may represent spiral fibres and single rows of discs points to the possibility of its being allied to the yew-tree.

Some of the lignite seems to be composed of fragmentary vegetable matter, and is not unlike that from near Cape Stephen, which contains the macro- and microspores.

There are several pieces of a sandy shale which is exceedingly friable and almost black with carbonised vegetable remains; but these are so altered that at present nothing distinct has been made out, and the nature of the plants is uncertain.

The compressed mass of plant-remains is very recent-looking; it is mixed with a little muddy matrix, and readily breaks up on soaking in water; when this is done the mass separates into small pieces, perhaps $\frac{1}{8}$ inch wide and, say, 1 inch or less in length, flat, and as thin as paper. With these are other fragments, broader, but, like the first, so much altered that nothing can be made out of them. Mr. Clement Reid, who is so familiar with Pleistocene plants, has seen these, and feels sure that they are not so recent as Pleistocene, but thinks that they might be of Tertiary age. Dr. Nathorst, judging by the absence of dicotyledons, is of opinion that they belong to the Jurassic period.

RAISED BEACHES.

The occurrence of raised beaches in many places in Franz Josef Land is well established. One was noticed by Mr. Leigh

Smith at Gray Bay, west of Cape Grant, 90 feet above sea-level. Mr. Jackson's hut at Elmwood is on an old sea-beach 40 to 50 feet above the sea, while there are others at higher and lower levels. The bones of a whale (probably *Balaena mysticetus*) are mentioned as being found near Mr. Jackson's hut. Similar raised beaches occur on Frederick Jackson Island, showing that the movement of upheaval is not confined to the southern parts of Franz Josef Land, where most observations have been made. At the northern end of Günther's Bay raised beaches were observed by Dr. Koettlitz, and from the lower one pebbles of basalt and specimens of *Saxicava arctica* were collected; similar beaches were also seen by the Jackson-Harmsworth party at Cape Crowther, at Cape Stephen, at Hooker Island, and at Windy Gully; from the latter, *Trophon antiquus*, *Tr. gracilis*, *Mya arenaria*, and *Balanus concavus* were obtained.

SILICIFIED WOOD.

The common occurrence of silicified wood has been noticed by all who have visited Franz Josef Land. Lieut. Payer alludes to it; Mr. Leigh Smith and Mr. Grant collected specimens; the first consignment of fossils from the Jackson-Harmsworth expedition contained some fine specimens; Dr. Nansen also notices it; and the present series of specimens from the Jackson-Harmsworth party includes many examples, some of which are large and formed part of a tree-stem.

This silicified wood is widely distributed in the Franz Josef archipelago, for Lieut. Payer's specimens must have been from the eastern islands, while we have evidence of it from Capes Flora, Crowther, Neale, and Gertrude. Mr. Leigh Smith's specimens seem to have been found on Mabel Island. In nearly every case this wood has been found on the talus-heaps, and the only place where it has been found *in situ* is at Cape Gertrude, where Dr. Koettlitz and Mr. Child discovered a mass of it embedded in the lower part of the basalt at a height of more than 700 feet above the sea. On the plateau at the summit of Cape Neale, which is 700 feet above the sea, a large silicified tree-trunk was found projecting from the soil, and therefore above the 250 feet of basalt which there caps the Cape.

It is difficult to assign any age to this wood. It is possible that a Tertiary basalt overwhelmed forests of pines growing at that time, and that the same kind of trees subsequently grew on the surface of the sheets of basalt. Or it may be that some already existing plant-beds were invaded by the intruding basalt, in which case the moving mass might in some instances have passed over, and in others passed under, the plant-bed; or there may have been more than one such bed.

It is well-nigh certain that this silicified wood is not earlier than Upper Jurassic, for it almost certainly occupies a position above the Oxfordian fossil-bed; but of this we have no positive proof, seeing that the beds exposed at Cape Gertrude have yielded no fossils to indicate their age. It is quite possible, therefore, that some of this silicified wood may be of Upper Jurassic, Cretaceous, or Tertiary age. On the whole, it seems most in accordance with the known facts to regard it as of approximately the same age as the basalts, which are probably of Tertiary date.

Judging from the report of Mr. Leigh Smith's visit to Franz Josef Land,* and Mr. Etheridge's remarks in the discussion,† it was thought that the pine-cone, the silicified wood, and the plant-impressions there mentioned were all from one horizon; but no evidence was brought forward proving that such was the case. Mr. Carruthers, who examined the pine-cone, was of opinion that it was of Cretaceous age; and the presence of Cretaceous rocks in Franz Josef Land rests upon that opinion. It is by no means clear, however, that the silicified wood is Cretaceous, even if the evidence of the pine-cone be accepted; but there now seems to be some doubt as to the age of the cone.

The manner in which this silicified wood is preserved merits attention; in some cases the replacement by silica has been so brought about that the form of the finest tissues is extremely well preserved, and, being of a dark brown colour, sections under the microscope show their structure even better than recent wood. The large longitudinal cells of the woody tissue are clearly defined, as are also the medullary rays which cross them, but the feature which is the most striking and at the same time the most

* "Proc. Roy. Geogr. Soc." n. s. vol. iii. (1881) p. 105.

† *Ibid.* p. 147.

characteristic is the well-marked series of discs (dotted tissue) which are typical of coniferous wood, and are in this instance large, and arranged in single and double rows in the cells. Transverse sections show the usual annual rings.

There is much difference in the degree in which the finer tissues of this fossil wood are preserved, some examples, like that above described, seeming to have every feature of the original structure retained, while in others this is nearly or quite obliterated. Some sections of black flinty fragments which have been examined have traces of tissue so faint as to leave doubt concerning its vegetable origin; and there are many intermediate stages between the two extremes. It may be mentioned also that silicified masses of vegetable matter other than wood have been collected, but these may not be of the same geological age. One such block, from the talus at Cape Stephen, on which there is a leaf of *Ginkgo* and a piece of a pine-branch, has already been noticed.

The preservation of this wood in close relation to the basalt is of much interest, for it is not only in Franz Josef Land that there is this association, but it has been noticed in many other places. Under very similar conditions wood has been found interstratified with the basalts of Greenland; the same conditions are present in the Western Islands of Scotland, where *Pinus eiggenensis*, sometimes silicified and sometimes preserved in carbonate of iron, occurs under the Scur of Eigg, as described by Hugh Miller in the "Cruise of the *Betsy*"; and coniferous wood was found by Sir A. Geikie under the basalt in the Island of Canna.*

The common occurrence of silicified wood on the shores of Lough Neagh, Ireland, is well known, and is stated to be derived from clays which are there found under the basalt.† Silicified wood has also been met with in the basalt of the Giants' Causeway.

It would be interesting to know whether similar conditions have existed in other places where silicified wood has been so abundantly found, such as near Cairo, in Antigua, in Arizona, in Tasmania, &c. In some of these localities volcanic conditions do

* "Quart. Journ. Geol. Soc." vol. lii. (1896) p. 362.

† See W. W. Watts, "Guide to the Collections of Rocks and Fossils in the Museum of Science and Art." 1895, p. 69.

obtain, but further information as to the precise relation of the silicified wood to the volcanic rocks is desirable.

In addition to the specimens above described the collection contains material from the surface of a floe, 48 miles south of Bell Island, and from the under-surface of an iceberg found, tilted up, off Eira Cottage.

That from the floe is a brown mud composed of extremely fine, brownish, amorphous particles, with which a few diatoms are associated. A partial analysis gave the following result :—

SiO ₂	.	.	.	.	.	49.88
TiO ₂	.	.	.	.	.	.28
Al ₂ O ₃	.	.	.	.	.	18.06
Fe ₂ O ₃	.	.	.	.	.	9.14
CaO	.	.	.	.	.	3.00
MgO	.	.	.	.	.	2.20
Loss on ignition	.	.	.	.	.	13.88
						<hr/> 96.44 <hr/>

The material from the iceberg is a greenish sand, containing shells and fragments of *Mya truncata*, *Balanus concavus*, *Balanus porcatus*, and *Saxicava arctica*; also some small subangular pebbles. The sand is principally composed of quartz and felspar, but contains also hypersthene, zircon, iron-ores, rutile, tourmaline, and garnet. The subangular pebbles are formed of basalt, sandstone, and black radiolarian chert. A section of the chert has been examined by Dr. G. J. Hinde, F.R.S., who has kindly furnished us with the following description :—

“ The thin section of the small rolled pebble of light-coloured chert from Franz Josef Land is seen under the microscope to be filled with casts of radiolaria. The structure of these organisms, as is usually the case, is now entirely obliterated, and they appear as minute transparent bodies with circular, oval, or discoidal outlines in the cherty matrix. Most of them are smooth, but a few have projecting spines. They range from 0.06 to 0.19 mm. in diameter; in general, the forms are relatively smaller than those usually met with in a chert. Judging from their outlines, several genera are represented in the section; the most numerous are the simple round and oval forms belonging to *Cenosphaera* and *Cenellipsis*, and the rarer spined ones may be probably referred to

Xiphostylus and *Dorysphæra*. Though the horizon of the rock from which this pebble comes cannot be positively determined from these imperfectly preserved radiolaria, it is not improbably of Palæozoic age. The character of the chert itself is precisely similar to that of the radiolarian chert of the Palæozoic rocks of Devon, Cornwall, and the South of Scotland."

It is a curious circumstance that among the few specimens brought from Joinville Island in the Antarctic region, south of the Falkland Isles, was one of radiolarian chert; thus this rock has been found, though not *in situ*, in the most northerly and most southerly lands yet visited.

Rocks showing cone-in-cone structure are very abundant near Cape Flora, and have been found at several localities. Numerous specimens have been collected, but unfortunately not one of them was found in place, so that the exact horizon from which they come cannot be determined. As they are found all round the Cape, and sometimes high up on the talus, it is probable that they form a band or bands situated not far below the basalt.

The rock is an argillaceous limestone, and the carbonate, which has produced the structure by its attempts to crystallise under unfavourable circumstances, is rich in lime and poor in iron and magnesia.*

VI. THE RELATIONS OF THE VARIOUS FOSSILIFEROUS HORIZONS.

In order to give some idea of the relations of the various beds of fossils above noticed, and of their probable place in the geological sequence, a vertical section has been made of the strata at Cape Flora, relying upon the various heights above the sea, at which the different beds are said to occur, for the position of these beds in the section; but it must be remembered that the figures supplied to us are only approximately accurate, and are liable to correction by further measurements.

The sedimentary strata in the south of Franz Josef Land are believed to be regularly horizontal, with only a slight dip to the north-east, and consequently within the area of Cape Flora it is

* See G. A. J. Cole, "On some Examples of Cone-in-cone Structure," "Min. Mag." vol. x. (1892) p. 136.

unlikely that there will be any serious variation in the height of the same bed at different parts of the cliffs.

Cape Flora is said to be 1100 feet high ; the upper 500 feet is basalt, while the lower 600 feet is made up of sedimentary rocks,

1300 ft. above sea level

1100

5 ft. thick

Glacier sh.
Plant bed over basalt
700

, *Ginkgo*, &c.

600
East of Elmwood shale basalt
Elmwood watercourse
500

mites Lamberti
. *T. cheftkini?* in place
. *macrocephalus*
. *modiolaris*, &c.

Windy gully 400

Ischnura and *Belemnites*

300

500 yds. west of Elmwood
30 to 40 ft

Ischnura and *Belemnites*
level

DIAGRAM SECTION OF STRATA SEEN AT CAPE FLORA

covered for the most part by talus. The base of the basalt is thus placed at 600 feet above the sea, and the positions of some of the beds, as we shall see, are reckoned by their distance below the basalt. Thin beds of basalt are said to occur in the clay-beds, but as the exact position of these is not stated, they are left out

of the section ; and for the same reason the seams of coaly lignite noticed in these clay-beds are omitted.

There is one horizon, however, the age and position of which are definitely known : it is that which occurs at the back of Elmwood, at about fifty feet below the base of the basalt. At this spot a bed (No. 3) was found *in situ*, and from it a small ammonite was obtained, which is probably *Ammonites Tchefkini*. In the watercourse below this exposure similar ammonites were found, together with *A. modiolaris* and *A. macrocephalus*. These suffice to settle the age as Lower Oxfordian, and probably the equivalent of our own Kellaways Rock. Although only one ammonite was really found *in situ*, yet it is sufficiently certain that the others, if not from the same place, came from beds but little lower in the series. Similar fossils to these occur in the talus at many places around Cape Flora, showing the probability of the same beds being present all round the Cape.

The belemnites which were collected during the *Eira* Expedition by Mr. Grant, apparently on Mabel Island, and said to be of Oxford Clay age, probably belong to this horizon.

How much of the beds above and below the *Ammonites macrocephalus* horizon is to be included in the Lower Oxfordian one cannot say, no distinctive fossils having been found. The thin bands of shale (No. 2) which occur just above the *A. macrocephalus* horizon and close under the basalt have yielded no fossils.

On the north side of Cape Flora, at a height of about seven hundred feet, the bed with plant-remains (No. 1) occurs ; it is said to be *in situ*, and overlying a mass of basalt projecting through a glacier. This locality is about a mile north-west of Elmwood—that is, on the supposed strike of the beds ; it is therefore included in the section at the height given. It is difficult to decide whether this plant-bed should be included in the Oxfordian or not. Dr. Nathorst's opinion—that it is of Upper Jurassic age—carries great weight. If the basalt be intrusive, then the two beds (1 and 3) may originally have been nearer together than they are now. We must await further evidence before the point can be fairly discussed ; in the meantime these plant-

bearing shales are the highest fossiliferous horizon that has yet been found in place in Franz Josef Land.

The specimens of *Ammonites Ishmæ* discovered at Windy Gully, at 300 feet above the sea, are believed by Dr. Koettlitz to have been in place—that is to say, he is of opinion that they belonged to the bed on which they were found. This horizon, therefore, is placed in the section at 300 feet above the sea, and is thus 250 feet below the *Ammonites modiolaris*-bed, but this distance may be too great. The ammonites and belemnites of this bed are not of the same species as those found in the *Ammonites macrocephalus*- and *A. modiolaris*-horizon; and it is quite possible that we may have in this *A. Ishmæ*-bed a representative of another formation, perhaps of the age of the Cornbrash.

The lowest horizon seen at Cape Flora is the bed exposed at about thirty to forty feet above the sea, a little to the west of Elmwood (No. 5). Except for the fact that this bed is situated some two hundred and fifty feet lower in the series than the place where *A. Ishmæ* was found, there is nothing to give a clue to its geological horizon. The large *Avicula* has not been identified, and the belemnites, although resembling those found with *Ammonites Ishmæ*, are not perfect enough for identification.

The numerous thin beds (No. 6) at Cape Gertrude, that occur at a height of from four hundred to six hundred feet above the sea, having yielded no fossils to indicate their age, cannot be correlated with the section at Cape Flora; and it is only their elevation above the sea that points to a possible correspondence with the *Ammonites macrocephalus*- and *A. modiolaris*-series.

We now come to what seems to be the lowest horizon from which fossils have been collected in Franz Josef Land—namely, the plant-bearing sandstone at Cape Stephen (No. 7), which was also found exposed farther south-west, towards Cape Grant. As this locality is more than twenty miles west of Cape Flora and the structure of the intervening islands is not known, it is hazardous to attempt to correlate the beds at the two places. But, at the same time, if the strata of the south of Franz Josef Land are uniform in their north-easterly dip, then, as this plant-bed is near the sea-level at Cape Stephen, we should expect to find it or its equivalent at some distance below the sea at Cape

Flora; and the possibly Lower Oolite age of the plants points to a similar position in the series. On the other hand, as already pointed out, these beds may be of much greater antiquity.

The presence of a plant-bed at the top of these Oolitic strata of Franz Josef Land, and the occurrence of lignite-beds in many places below, show that estuarine, if not indeed freshwater, conditions must have prevailed during a large part of the time when they were being deposited; but, on the other hand, the horizons with *Ammonites* and *Belemnites* point to times when marine depositions intervened.

Strata of Oolitic age have been met with in Spitzbergen by Professor Nordenskjöld,* and the presence of *Ammonites triplicatus* would seem to indicate that they belong to higher beds than have been recognised in Franz Josef Land, unless indeed they correspond with the upper plant-bed of Cape Flora.

More recently two species of Jurassic ammonites have been recognised from Spitzbergen by Dr. Fraas,† namely *Ammonites triplicatus* and *A. cordatus*, from which one can only conclude that beds are present which in Britain would be called Upper Oxfordian.

Numerous Jurassic fossils were collected by Professor Nordenskjöld in Novaya Zemlya, and have been described by Professor Tullberg.‡ Among these *Ammonites alternans* is found, thus indicating the presence of beds of Kimeridgian age in that country.

The question of the age of the silicified wood has already been alluded to, and little further can be said. The occurrence of this wood below the basalt and near to probable Jurassic deposits shows that some of it may perhaps be of Jurassic age; but it may equally well be of Cretaceous or Tertiary date. Even if future discoveries confirm the supposed Cretaceous age of the pine-cone from Bell Island, this will not necessarily prove the silicified wood to be of the same age.

* "Sketch of the Geology of Spitzbergen," 1867, p. 27.

† "Neues Jahrb." 1872, p. 203. See also Raymond and Dollfus, "Geol. Spitzbergen," "Feuille des Jeunes Naturalistes," 1897, Nos. 286, 287, 288.

‡ "Verstein. Nowaya Semlya," "Bihang till Svenska Vetenskap. Akad. Handl." vol. vi. (1880) pt. ii.

The possibility of Tertiary beds being present is shown by the silicified slab from Cape Stephen, the *Ginkgo* seeming to be the same as *G. reniformis*, which is from beds believed to be of Tertiary age.

The plant-remains found near Cape Richthofen may likewise be of Tertiary age, as already mentioned, but the evidence is so slender that it must be taken rather as a suggestion of something to be looked for in the more northern parts of Franz Josef Land than as a proof of the presence of beds of so late a date. The fact that beds with abundant plant-remains of Tertiary age have been found in Spitzbergen shows that similar deposits may be expected here. It will be remembered that the specimens from Cape Richthofen were found upon a high lateral moraine, and therefore presumably were derived from beds directly above this moraine, or it may be were brought from a distance; in either case it is quite possible that they may yet be found *in situ*. The plant-remains themselves have a very recent look, but it is hardly likely that they can be more recent than the Glacial Period; indeed, Mr. Clement Reid's opinion goes far to show that they are of earlier date than Pleistocene, and may be Tertiary, or even, as Dr. Nathorst thinks, of Upper Jurassic age. These plants, however, are so poorly preserved, and their place of origin is so uncertain, that we can only hope for additional specimens which may throw light upon this interesting but obscure question.

VII. CONCLUSION.

In conclusion, we may perhaps be allowed to sketch out briefly the salient features in the geological history of Franz Josef Land, so far as this can be done in the light of our present knowledge. Passing over the plant-bed at Cape Stephen, the age of which is uncertain, the first event of which we have any record is the deposition of a series of shales and sandstones containing plant-remains, beds of lignite, and other evidences of littoral or estuarine conditions. Intimately associated with these shallow-water deposits are some purely marine beds, the age of which is placed beyond all doubt by the occurrence of such well-characterised zonal fossils as *Ammonites macrocephalus* and *A. modiolaris*.

Owing mainly to the brilliant researches of Neumayr,* it is now generally recognised that the Jurassic sea reached its greatest extension in the present land-areas during the Callovian and Oxfordian periods. Hydrocratic and geocratic movements alternated during Jurassic times, with a decided balance in favour of the former, and a recession of the coast-line towards the north. Even in the North of Scotland we find no decided evidence of the proximity of land during the Oxfordian period, although the lower portions of the Jurassic formation are represented by littoral and estuarine deposits.†

Under these circumstances the discovery of *A. macrocephalus*-beds in Franz Josef Land in association with plant-bearing strata is of special interest. It extends the range of this ammonite several degrees towards the north, and shows, in all probability, that during the period of its existence a coast-line lay somewhere in this direction. Marine deposits of Callovian and Oxfordian age are now known to range from Sutherland to Cutch and from Franz Josef Land to the north of Africa; and *A. macrocephalus* is one of the most widely distributed of all Jurassic ammonites.‡ The soft Jurassic sediments were subsequently covered up and preserved from destruction by vast flows of basaltic lava; and it is not a little remarkable that rocks of the same general period have been preserved in the same way in districts so far removed from Franz Josef Land as the North-west of Scotland§ and Abyssinia.|| We have already pointed out that Dr. Nansen refers the basalt in part to the Jurassic period; but in view of the fact that the basalts of the West of Scotland were at one time

* "Die geographische Verbreitung der Juraformation," "Denkschr. d. k. Akad. d. Wiss." Wien, vol. 1. (1885) pp. 57-142.

† J. W. Judd, "The Secondary Rocks of Scotland," "Quart. Journ. Geol. Soc." vol. xxix. (1873) p. 164, and vol. xxxiv. (1878) p. 726.

‡ It not only occurs in Central and Southern Europe, Northern Russia, and Franz Josef Land, but also in Cutch (Waagen, Pal. Indica, ser. ix. vol. i. 1873) and Bolivia (Steinmann, Neues Jahrb., Beilage-Band i. 1881, p. 239). It has also been recorded from Western Australia (Moore, "Quart. Journ. Geol. Soc." vol. xxvi. 1870, p. 226), but Neumayr throws doubt on the identification (*op cit.* p. 118).

§ J. W. Judd, "The Secondary Rocks of Scotland," Second Paper, "Quart. Journ. Geol. Soc." vol. xxx. (1874) p. 220.

|| Aubry, "Observations géologiques sur les Pays Danakils," &c., "Bull. Soc. Geol." France, ser. 3, vol. xiv. (1886) p. 201.

supposed to be of the same age, for reasons very similar to those relied upon by him, this conclusion cannot be regarded as definitely established. At the same time it is important to notice that, if we except the North of Ireland, the Upper Cretaceous period is unrepresented, or but feebly represented, by sedimentary deposits in regions like the Deccan of India and the high plateaux of Abyssinia, where basalts are extensively developed. It is therefore quite possible that the vast outpourings of basic lavas which have given a special character to extensive areas of the earth's surface* may have commenced in pre-Tertiary times.

The present configuration of the archipelago of Franz Josef Land conclusively proves that it is formed of the fragments of an old plateau. The land frequently ends off in very high cliffs, capped with sheets of basalt which must have extended far beyond their present limits. When one compares the topography of this district with that of the Færöes and the West of Scotland, one is inclined, notwithstanding the immense tracts of water which now separate these localities, to ask whether they may not at one time have been continuous, and whether the northern portion of the North Atlantic, as suggested by Suess,† may not be of comparatively recent origin.

But whatever answer may be given to this question, it is clear that at the close of the volcanic period the various islands of Franz Josef Land were united and formed part of an extensive tract of land. This land was subsequently broken up, partly, in all probability, by the sinking of certain areas along lines of fault, and partly by denudation.

The final stages in the history of the district are represented by the raised beaches, which prove that this region, like so many other portions of the extreme north, has quite recently been under the influence of a geocratic movement.

* The Deccan traps cover an area of about 200,000 square miles. "Geology of India," 2nd ed. 1893, p. 256.

† "Are Great Ocean-Depths Permanent?" "Natural Science," vol. ii. (1893) p. 185.

ABSOLUTE DECLINATIONS AT CAPE FLORA

BY A. B. ARMITAGE

1896					1896					1896				
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"	4	.	.	16 35 33	"	6	.	.	15 16 54	"	13	.	.	14 7 55
"	4	.	.	13 53 31	"	6	.	.	14 51 24	"	16	.	.	14 48 53
"	5	.	.	15 57 48	"	7	.	.	14 58 7	"	16	.	.	14 44 2
"	5	.	.	15 1 8	"	7	.	.	5 47 37	"	20	.	.	14 53 23
"	6	.	.	14 38 15	"	8	.	.	15 4 19	"	23	.	.	15 5 53
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"	10	.	.	14 19 6	"	13	.	.	15 56 1	"	4	.	.	16 33 48
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"	25	.	.	15 13 16	"	29	.	.	15 28 32	"	31	.	.	14 11 26
"	25	.	.	15 8 15	"	30	.	.	15 50 31	1897				
Sept.	27	.	.	15 9 43	Nov.	3	.	.	15 11 24	Jan.	1	.	.	14 33 29
"	28	.	.	15 28 50	"	3	.	.	15 16 57	"	2	.	.	12 37 9
"	28	.	.	15 26 50	"	4	.	.	15 12 57	"	3	.	.	13 48 41
"	29	.	.	15 27 32	"	4	.	.	15 2 10	"	4	.	.	14 26 48
"	29	.	.	15 4 29	"	5	.	.	15 21 48	"	5	.	.	14 29 38
"	30	.	.	15 14 59	"	5	.	.	14 56 32	"	7	.	.	14 35 30
"	30	.	.	15 19 14	"	6	.	.	16 31 5	"	8	.	.	14 26 45
Oct.	1	.	.	14 44 25	"	6	.	.	14 12 40	"	10	.	.	14 30 25
"	1	.	.	15 10 43	"	7	.	.	11 57 18	"	12	.	.	14 15 26
"	2	.	.	15 15 43	"	9	.	.	16 19 34					

TEMPERATURES OF SOIL, WATER, &c.

TAKEN BY H. FISHER

		Local mean time.	
1896			°
Midsummer Day	Sandy soil 3 in. below surface	Noon	+ 44 F.
June 21	„ 6 in. „	„	+ 40
	Sunk in a bed of snow at sea level, 12 in.	I P.M.	+ 32
	Running water (rill with ice bottom) in shade	„	+ 32
	Pool of water having no streams running into it. 80 yards long, by 40 yards wide. 6 in. below surface	Noon	+ 41
	Air, at 43 ft. (In screen 34° F.)	„	+ 36
	Sun trying to break through clouds and almost succeeded by	I P.M.	
June 22	Elmwood Tarn	7.30 P.M.	+ 43.5
	Smaller pool (3 in. deep)	„	+ 44.5
	Air	„	+ 35.5
	Light airs W. by N. Showers of rain at intervals, dull, misty	„	
June 30	Tarn	9.45 P.M.	+ 48
	Air. Sun shining all day	„	+ 32
July 2	Tarn	7 P.M.	+ 46
	Shallow pool	„	+ 50
	Air	„	+ 35
July 9	Tarn	4.15 P.M.	+ 54
	Shallow pool	„	+ 58
	Air. Very brilliant sunshine all day	„	+ 35

APPENDIX

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TEMPERATURES OF SOIL, WATER, &c.

		Local mean time.	
1895 Midsummer Day June 21	Alt. 40 ft. Sandy soil 3 in. below surface	8 P.M.	+ 38 F.
	Do. do., 4 in. below surface	"	+ 36
	Alt. 40 ft. Damp stony soil 6 in. below surface	"	+ 33.5
	Do. do., 6½ in. below surface	"	+ 32.8
	Alt. 80 ft. Snow on flat ground 12 in. below surface	"	+ 31
	Alt. 60 ft. Running water 10 in. below surface	"	+ 32.5
	Alt. 60 ft. Pool of water, having no streams running into it, 80 yards long by 40 yards wide, 6 in. below surface	9.45 P.M.	+ 39.5
	Alt. 60 ft. Air	9.30 P.M.	+ 31
	" " Earth 12 in. below surface	"	+ 28.5
	Alt. 60 ft. Air	Noon.	+ 33.8
June 22	" " " Max. last 24 hours	"	+ 36.5
	Bright sunshine. Strong breeze, force 5 to 6	2.30 P.M.	—
	Alt. 40 ft. Damp sandy soil 4 in. Strong breeze	"	+ 37.5
	Alt. 40 ft. Damp greasy loam 4½ in. Strong breeze	"	+ 32.0
	Alt. 40 ft. Damp greasy loam 2 in.	"	+ 35.0
	Alt. 40 ft. Damp greasy loam 1½ in.	"	+ 38.0
	Alt. 40 ft. Air in screen	3 P.M.	+ 35.0
	" " Stone soil top of bed 5½ in.	"	+ 35.0
	Alt. 40 ft. Pool of water (tarn) W. end	"	+ 44.0
	Alt. 40 ft. Pool of water (tarn) S.S.W. side	"	+ 45.0
	Alt. 40 ft. Shallow pool, 3 in deep. Bright sunshine, strong N.W. wind	4.30 P.M.	+ 46.0
June 24	Minimum temperature of air	"	+ 25
June 25	Air	"	+ 24.5
June 26	Ice on puddles of water, ½ in. thick	10 A.M.	—
	Tarn	2 P.M.	+ 41.5
	Shallow pool, 3 in.	"	+ 43
	Air	"	+ 30
	Alt. 250 ft. Damp soil on talus. 3 in. below surface	2 P.M.	+ 33
	Alt. 40 ft. Sandy soil 6 in.	"	+ 25
	" " " " 3 "	"	+ 37

TEMPERATURES OF SOIL, WATER, &c.—(continued).

		Local mean time.	
1895			°
June 26	Sunshine	1 P.M.	—
	Alt. 40 ft. Air. N.N.W. wind with snow at 2 P.M.	Noon	+ 31 F.
	Tarn after five hours' snow with N.W. wind	6.30 P.M.	+ 34.5
	Air	"	+ 30
June 27	Alt. 40 ft. Air	10 A.M.	+ 33.8
	Air	1 P.M.	+ 35
	Tarn	"	+ 38.5
	"	5.30 P.M.	+ 39
	Air	"	+ 33
June 30	Alt. 40 ft. Air	Noon	+ 38.5
	Snowing slightly	5.30 P.M.	—
	Tarn, snowing slightly	"	+ 45.5
	Sandy soil, 2 in. Snowing slightly	"	+ 46
	" " 3 in. Snowing slightly	"	+ 43
	" " 6 in. Snowing slightly	"	+ 41
	Air, N.N.W. wind. Snowing slightly	"	+ 37
	Shallow pool 3 in. N.N.W. wind	8 P.M.	+ 46
	Tarn. N.N.W. wind	"	+ 45.5
	Tiny bog pool, 2 in. N.N.W. wind	"	+ 43
	Air	"	+ 37
	Max. air last 24 hours	"	+ 40
	Ice on shaded water by Sharp's Rock	10 P.M.	—
	Ice on puddles of water against house	Midnight	—
July 2	Cape Gertrude. Air	7 P.M.	+ 33
July 3	Air	1.30 A.M.	+ 29
	"	2 P.M.	+ 39.5
	"	8 "	+ 39
July 4	Alt. 40 ft. Air	9.15 A.M.	+ 37.5
	Mossy and grassy spongy turf	"	+ 41
	Sandy soil edge of turf	Noon	+ 48
	Pool in ice	6 P.M.	+ 37
	Water between boulders and shore ice	"	+ 49
	Running stream by tent	"	+ 47
	During last night the streams stopped running		
	Air	"	+ 45
	"	6.45 P.M.	+ 43
July 5	" East wind	9 A.M.	+ 37.5
	Snow at 7.45 A.M., hail at 9.15 A.M.		
	Air (shade, sun shining in wind)	2.30 A.M.	+ 42
	Stream running through the night		
	Air	10 P.M.	+ 37
July 6	"	9 A.M.	+ 37.5
	"	Midnight.	+ 35
July 7	"	2 P.M.	+ 39

TIDAL OBSERVATIONS TAKEN AT CAPE FLORA BY
A. B. ARMITAGE.

August 26th, 1895.—High water at 1.5 P.M. Height on pole,
1 ft. 7.2 in.

September 3rd.—Low water at 4.28 P.M. Height on pole,
9.7 in.

September 4th.—High water at 9.47 A.M. Height on pole,
1 ft. 6.8 in.

September 4th.—Low water at 4.35 P.M. Height on pole,
5.0 in.

September 4th.—High water at 10.45 P.M. Height on pole,
1 ft. 7.0 in.

September 5th.—Low water at 4.7 P.M. Height on pole,
7.4 in. From 10-minute observations.

The tides here come in and run to the eastward, along the coast, with a rising tide; and go out and run to the westward with an ebb tide.

They are, however, greatly influenced by the winds in the above respect; and with a wind of force 6 and above from an easterly or westerly direction, will either remain neutral or flow slowly in an opposite direction to that which they generally take.

The winds also appear to affect the rise and fall of the tide.

The range of tide appears to vary between 1 ft. 1 in. and 1 ft. 3 in.

The highest tide registered on the tide pole was on September 3 at 9 A.M.—2 ft. 00.2 in.

The lowest tide registered was on August 27 at 9 P.M.—2.2. in.

The tide appears to turn and run to the westward about twenty minutes or half an hour before it has finished rising; and the same occurs before it has finished falling.

The tide moves very slowly at neaps, and is slack for a considerable period of time.

At springs it moves with rapidity, about 21-3 knots per hour ; and there is practically no slack water.

POSITIONS OBTAINED BY OBSERVATIONS OF ☉ ON
BOAT JOURNEY

JULY 11 TO AUGUST 12, 1895

	Latitude.	Longitude W. of Cape Flora.	Variation, E.
	° ' "	° ' "	°
July 13 and 20, and August 5 at Cape Grant	80 02 45	2 10 31	—
July 22 at Cape Crowther	80 10 36	3 01 01	—
July 23 and 28 at Cape Neale . .	80 16 18	3 23 55	11½
August 6 and 7 at Cooke Rocks . .	80 03 29	2 00 58	13½
August 8 and 9 at Cape Stephen . .	80 03 30	1 45 52	14
August 10 at Bell Island	80 02 29	0 54 15*	13½

* Worked with latitude 80° 02' 30".

REPORT ON THE FLORA OF FRANZ JOSEF LAND FROM
CAPE BARENTS TO CAPE NEALE. BY MR. H. FISHER,
BOTANIST TO THE EXPEDITION.

PHANEROGAMS.

THERE are eleven small tracts of land on the south-western shores of Franz Josef Land, which are separated by glaciers. Four of the localities are on these islands, the others are on Alexandra Land. From the following account it will be seen that the flora is strikingly insular. There are no endemic types, but the glabrous state of *Luzula congesta* is not known elsewhere in Arctic or other regions. *Pleuropogon*, which was till now supposed to be confined to the Polar American islands and Novaya Zembya, has unexpectedly turned up in Franz Josef Land. Malmgren thought the North Spitzbergen flora seemed to be connected with Arctic America. *Pleuropogon* may have lingered on the one favourable spot, whilst other species have died out.

In warmer times a current may have passed over the Pole between Polar America and Franz Josef Land. There are so many peculiarities in the distribution of plants that any attempt to account for the presence of *pleuropogon* here seems to me useless.

Compared with other floras of Polar regions South-west Franz Josef Land has fewer species than almost any other. There is a cold current running in a westerly direction, all the land being ice-capped.

There are no rivers, or streams, or lakes. Small rills and pools of water occur here and there, supplied by the melting snow.

The flora consists of 15 Dicotyledons and 8 Monocotyledons—8 natural orders, 15 genera, and 23 species.

Proportion of genera to species is as 1 to 1.53.

The following table may be of interest, showing as it does, from a botanical point of view, that Franz Josef Land, though not the most barren region, as Payer supposed, is inferior to some others; but the early spring (March and April) being the only time he had for collecting rendered it impossible for him to decide upon such a point.

PHANEROGAMS.

Spitzbergen has	96 species
East Arctic Greenland	85 „
Grinnell Land	69 „
Melville Island	60 „
Islands north of Barrow Straits and Lancaster Sound	50 „
Melville Bay, Wolstenholme and Whale Sounds	23 „
Walden Island	9 „
Ross's Islet (Seven Islands)	0 „
Herald Island	4 „
Franz Josef Land	23 „

When 250 specimens of *Draba* from Franz Josef Land have all been examined, I shall find it necessary to increase the total number of species to 25 or 26.

A larger flora must not be expected here, because we have only six insects—moths, butterflies, and bees being all absent. Flocks of geese passed over; we may therefore suppose there is better land farther to the north or north-west.

Seedling plants of *Cochlearia* were in abundance in June on the débris of Gully Rocks, and on débris of Cape Flora in September.

No other plant reproduces itself by seed. *Cochlearia* is self fertilised. The highest temperatures during the 1895 summer were on July 4:

Sandy soil, mid-day	+ 48° F.
Rill, 6 P.M.	+ 47° F.
Air (in shade), 6 P.M.	+ 45° F.

The above readings were taken on Cape Gertrude ten feet above the sea-level.

Cape Barents differs considerably from all the other localities visited. Here, on the September 9th, 1894, when the rocks were as free from snow as at any time during the summer, one solitary flowering plant existed with a few lichens and mosses. There is neither talus nor raised beach here. Scarcely any flowering plants could exist on the bare rocks and boulders, which are exposed to all winds, particularly to the prevalent easterly blast.

Cape Gertrude has a comparatively long and wide beach with pools of water. Excepting *Saxifraga stellaris*, L. var. *vivipara* (which grows on a little stony bank on the raised beach about twenty feet above sea-level and about four hundred yards from the edge of the present sea-shore), there is nothing remarkable to be found. We camped on this Cape for a week, making a thorough search; the result being sixteen species—that is, two-thirds of the entire flora.

Cape Flora. Here I had more opportunities for collecting than elsewhere, although the boat journey and Cape Gertrude camp took up the best part of the summer. There are many suitable spots where one might reasonably look for Ericacæ, *Oxyria*, *Salix*, and Cyperacæ, all of which are absent.

The flora is quite as disappointing as that of Cape Gertrude. Lichens and mosses, though mostly barren, make a good show here. There are, however, very few species. (Sixteen species only of Phanerogams.)

Bell Island. Here there is a wide stretch of raised beach, unsuitable for vegetation, excepting certain low forms in the numerous pools of melted snow. Stunted and starved plants of fifteen species contrive to maintain an existence wherever there is sufficient soil.

Mabel Island. Facing south with high rocks to moderate the northerly winds, we have here a suitable beach for an improved flora. In two hours I found more forms than on the other capes already mentioned, including the most rare and beautiful little grass *Pleuropogon Sabinii*, R. Br., originally discovered on Melville Island by Sir Edward Sabine and afterwards on other islands, &c.,

in that region, but not in Grinnell Land, Greenland, or Spitzbergen.

Pleuropogon is the only genus peculiar to the Arctic regions. There are also other plants of some interest here, viz., *Luzula campestris*, var. *congesta*, *Lej. f. glabra*. (Typical *L. congesta* is found in Greenland and Grinnell Land but not in Melville Island or Spitzbergen.)

I found this* on Cape Stephen and on Cape Neale also. *Saxifraga stellaris*, L. var. *vivipara*, is here, but although the soil is apparently quite as suitable as that of Cape Gertrude and Cape Stephen, it is very stunted. This plant is very rare in Greenland, where it has been seen between 70° and 78° N. by Sabine on the east coast.

On the west coast it was found by Dr. Robert Brown at Jacobs-haven and at Egedesminde by Nares' Expedition (Hart), and Taylor found it on Kickerline Islands in Cumberland Gulf (East Arctic America).

In Spitzbergen it is not rare.† All the above localities are in much lower latitudes than the Franz Josef Land stations.

Potentilla sp.—Of this I found only one plant. There are probably two or three species here which I did not see. The time at my disposal was too short to enable me to examine more than a part of this interesting locality. Here are pools of water and a rill, larger than any others on this part of Franz Josef Land. On the banks of these waters one cannot fail to observe the absence of Cyperaceae.

Juncus biglumis is here, though smaller than on Cape Stephen and Cape Neale.

Cape Stephen (latitude 80° 3' 52" north). On the southeastern side there are more species than on any other cape, the only absentee being *Pleuropogon*.‡ On the other side of the cape it is extremely barren. There is a fine corrie on this side from which run numerous rills over a flat beach bare of vegetation. The summit of the cape is a plateau a little under the snow line quite free from snow on its southern half. A starved moss and

* Variety.

† *Saxifraga stellaris*.

‡ *Pleuropogon* was named by Robert Brown. Dr. Robert Brown, his namesake, on Nares' Expedition, was no relation.

lichen here and there represent the plant life. The aneroid read 1010 feet, a little too high, as was found by observation.* On the east side is a pool 120 yards long by 60 yards. At its southern end there is a spongy mossy depression. Such a spot as *Eriophorum* might be looked for, but search was in vain.

Cyperaceæ again are absent. Even *Juncus biglumis* and *Luzula congesta*, Lej., have found the drier bank above more favourable to their growth. On the moist grassy bank sloping away from the pool *Potentilla* is much more luxuriant than elsewhere in this part of Franz Josef Land.

Cooke Rocks (latitude $80^{\circ} 3' 45''$ north) under high precipitous rocks between Cape Stephen and Cape Grant. It was on this beach that I first noticed *potentilla*. About a dozen plants on dry sandy soil, close to the crumbling edge. This plant and *sagina* were the only notable species here. (There are nineteen species here.)

Cape Grant (latitude $80^{\circ} 2' 45''$ north). The soil on the southeastern side is kept damp by the frequent rills, and well manured by the numerous birds which breed on the cliffs above.

Cochlearia anglica, L. var. *fenestrata*, R. Br., abounds on the rich soil on this side. All the plants are very luxuriant here.

On the other side there is a corrie; at its base an old moraine; and below that raised sandy beaches on which a few plants find a home. If there were as much sunshine on this side we should probably find a richer flora than on the other; the rich soil not seeming to be so favourable to the number of species as it is to the luxuriance of the few.

Total number of species here seventeen, including *Cerastium alpinum*, L. var. *uniflorum*. This last form is apparently confined to Cape Grant, where beautiful plants are plentiful in one place.

Cape Crowther (latitude $80^{\circ} 10' 11''$ north). There is a good wide beach with small mossy pools. Nothing here requires special mention. Fifteen species only are to be found.

Cape Neale (latitude $80^{\circ} 16' 29''$ north). The southern side has numerous small rills spreading along the lower beach, chiefly from the glacier. There are patches of grass of inconsiderable

* 792 feet.

extent. In one place where the grass is well watered there is a carpet-like stretch of verdure.

Amongst the grass and saxifrages I found *Stellaria* in bloom, not more than six plants, however. In no other place does this plant flower. Here the *Stellaria* is smaller than usual. *Luzula congesta*, Lej., is also very small here. *Juncus biglumis* is finer here than at the other stations and also more plentiful.

All these plants are confined to a space of twenty square yards.

Saxifraga oppositifolia is much scarcer here than on any other cape. It is worthy of remark that this plant is scarce on all the three most western capes. There is more on the plateau at the summit of Cape Neale (altitude 700 feet by aneroid) than there is on the beaches below. There is apparently no reason why this should be so. Similar soil is to be found in both situations. Poppies are plentiful on the summit, which in its southern part is quite free from snow. A rill and a pool of water here do not favour the growth of any phanerogams (*Confervæ* grow sparingly in them).

Here on Cape Neale we have reached as far in a westerly direction as the flora is known to extend. There is no beach on either Cape Ludlow or Cape Lofley, and as far as we could see Cape Mary Harmsworth is very similar. What is beyond remains for the future to disclose.

I need only mention the plants which are generally distributed—that is to say, on every cape and island from Cape Gertrude to Cape Neale, both included. They are all common in Arctic regions generally.

Ranunculus nivalis, L.

Papaver alpinum, L.

Cardamine bellidifolia, L.

Draba alpina, L.

Cochlearia anglica, L. var. *fenestrata* (Br.).

Stellaria sp.

Cerastium alpinum, L.

Saxifraga oppositifolia, L.

„ *caespitosa*, L.

„ *cernua*, L.

Saxifraga rivularis, L.

„ *nivalis*, L.

Alopecurus alpinus, L.

Poa flexuosa, Wahl.

„ *vivipara*, and

Dupontia Fischeri, R. Br.

The most noteworthy facts in relation to the Franz Josef Land flora are :

The presence of *Pleuropogon* and the absence of Compositæ, Ericaceæ, *Pedicularis*, *Oxyria*, *Salix*, and Cyperaceæ.

(Signed)

HARRY FISHER.

February 19th, 1896.

SYNOPSIS OF WIND FORCES AND DIRECTION FOR MAY, JUNE, AND JULY, 1895.

Direction of Wind.	May. No. of hours observed.	Average force per hour. (Beaufort's notation.)	June. No. of hours observed.	Average force per hour. (Beaufort's notation.)	July. No. of hours observed.	Average force per hour. (Beaufort's notation.)	Total No. of hours observed.	Mean average force per hour. (Beaufort's notation.)
N. to N.E.	68	4.7	44	3.7	36	4.3	148	4.3
W.S.W. to N. by W. .	200	3.7	232	3.0	164	2.9	596	3.2
N.E. by E. to S. . .	120	3.4	108	2.3	76	2.5	304	2.8
S. by W. to S.W. by W.	28	1.5	32	1.5	16	1.5	76	1.5
Calm.	56	0.0	28	0.0	196	0.0	280	0.0
Winds which tend to open out western por- tion of the Barents Sea.								
N. to N.E. and W.S.W. } to N. by W. . . . }	268	3.9	276	3.2	200	3.1	744	3.4
Winds which tend to close western portion of the Barents Sea.								
N.E. by E. to S. . .	120	3.4	108	2.3	76	2.5	304	2.8
Neutral winds. S. by W. to S.W. by W.	28	1.5	32	1.5	16	1.5	76	1.5

SYNOPSIS OF WIND FORCES AND DIRECTION FOR MAY, JUNE, AND JULY, 1895.

Direction of Wind.	May. No. of hours observed.	Average force per hour. (Beaufort's notation.)	June. No. of hours observed.	Average force per hour. (Beaufort's notation.)	July. No. of hours observed.	Average force per hour. (Beaufort's notation.)	Total No. of hours observed.	Mean average force per hour. (Beaufort's notation.)
N. to N.E.	68	4.7	44	3.7	36	4.3	148	4.3
N.E. by E. to S. . .	120	3.4	108	2.3	76	2.5	304	2.8
S. by W. to S.W. by W.	28	1.5	32	1.5	16	1.5	76	1.5
W.S.W. to N. by W. .	200	3.7	232	3.0	164	2.9	596	3.2
Calm	56	0.0	28	0.0	196	0.0	280	0.0
N. to N.E. and W.S.W. to N. by W. . . .	268	3.9	276	3.2	200	3.1	744	3.4
Totals and Means .	472	3.2	444	2.6	488	1.7	1404	2.5

SYNOPSIS OF WIND FORCES

Direction of Wind.	No. of hours observed.	Average force per hour. (Beaufort's notation.)	No. of hours observed.	Average force per hour. (Beaufort's notation.)	Total No. of hours observed.	Mean average force per hour for the two (2) months.
N. to N.E. .	64	4.6	84	3.9	148	4.2
N.E. by E. to S. }	174	3.1	188	3.0	362	3.0
S. by W. to S.W. by W. }	12	1.3	16	2.6	28	2.0
W.S.W. to N. by W. }	120	2.3	80	3.6	200	2.8
Calm . . .	100	0.0	72	0.0	172	0.0
N. to N.E. and W.S.W. to N. by W. }	184	3.1	164	3.8	348	3.4
Grand total and average means for all directions	470	2.4	440	2.8	910	2.6

AUGUST 1ST, 2ND, 3RD, AND 4TH

Observed at Elmwood

Winds.	Hours observed.	Force.
S.E. . .	4	4.000
E.S.E .	56	3.928
	60	3.933 mean force.

POSITIONS OF CAMPS, &c., ON SLEDGING JOURNEY
APRIL 16TH TO MAY 13TH, 1895.

Date.	Observations.	Latitude N.	Longitude E.	Distance travelled in geographical miles.	Variation E.
April		° ' "	° ' "		°
16	—	79 57 30	00 00 00	—	—
16	⊙ D. R.	80 07 00	1 14 42	18	—
17, 18	⊙ O	80 09 52	2 17 00 D. R.	11	—
18, 19	⊙ D. R.	80 12 00	2 34 00	3½	—
20, 21	⊙ D. R.	80 17 30	2 33 00	35	—
21	⊙ D. R.	80 22 45	2 40 00	5½	—
22, 23	⊙ D. R.	80 32 00	3 01 30	11½	—
25, 26	⊙ O	80 35 20	3 35 56	7½	15½
27	⊙ O	80 47 18	3 35 56 D. R.	12	—
28, 29	⊙ D. R.	80 52 45	4 15 24	9	—
30	⊙ O	81 00 36	4 11 52	8	17
30	⊙ D. R.	81 04 36	4 10 51	10½	—
May					
1	⊙ D. R.	81 08 00	4 22 54		—
2, 3	⊙ D. R.	81 19 30	5 18 18	14½	—
4	⊙ D. R.	81 09 15	4 26 24	13½	—
4, 5	⊙ O	80 50 01	4 02 38	27	16½
6	⊙ O	80 40 37	3 45 05	11	16½
7	⊙ O	80 32 11	2 50 28	15½	18½
8	⊙ D. R.	80 21 00	2 01 00	14½	—
9	⊙ D. R.	80 19 45	1 42 00	3½	—
10	⊙ O	80 16 48	1 24 16	4½	20 20½ } 20½
11, 12	⊙ D. R.	80 05 00	0 43 00	14	
13	—	79 57 30	00 00 00	11½	—

Geographical miles . . 260¼ of 6107 ft.
Statistic miles . . . 301 of 5280 ft.

Travelling days 21 ; 12.4 geographical miles per day ; 14.3 statute miles per day.
⊙ = camp. O = observation for position. D. R. = Dead reckoning.

These distances are *direct*, and in all but two instances are measured *on the map straight* from one camp to another. Nothing is allowed for windings to avoid rough ice, &c.

ABSTRACT OF WEATHER ON SLEDGE JOURNEY NORTH
APRIL 16TH TO MAY 13TH, 1895.

- April 16th. Light N.W. airs. Cloudy overcast, and misty throughout.
- 17th. Light N.W. airs. Cloudy. Misty throughout.
- 18th. Calm throughout. Fine but misty.
- 19th. Gentle E.N.E. wind. Fine but cloudy.
- 20th. Light airs and winds from N. Fine and clear.
- 21st. Gentle to moderate S. and S.E. winds. Fine, very clear weather until 8 P.M., then clouded over and very fine snow fell all night.
- 22nd. Gentle S. and W. and moderate S.W. winds. Overcast and foggy with snow throughout day. Cleared slightly at noon.
- 23rd. Fresh E.N.E. winds increasing to moderate fresh, and strong gale. Overcast and misty throughout.
- 24th. Strong to fresh N.E. gale, decreasing to moderate gale at 11 A.M. and gentle N.N.E. wind at 5 P.M. Snowing all the previous night and until noon of 24th. Moderate gale from N. at midnight. Snow driving thickly throughout gale and whenever the wind force exceeded force 3. Mist hanging low down.
- 25th. Fresh to light N. wind till 6 P.M. Moderate W.N.W. wind at midnight. Overcast and misty with falling snow in the morning. Fine but misty afternoon.
- 26th. Gentle to light W.N.W. wind. Calm, fine, but misty till noon. From then till midnight fine clear weather.
- 27th. Moderate E. wind, increasing to a moderate gale at 5 P.M., which rapidly increased to a fresh and strong gale. Fine but misty in the earlier part of day. Over-

- cast and with falling snow from 4 P.M. Snow driving fiercely and thickly throughout. Gusts at storm force (force 11).
- 28th. Strong gale from S.E. decreasing to moderate wind at 4 P.M. Gentle S. wind at 8 P.M., and light S.S.W. airs at midnight. Overcast and misty with falling snow throughout. Gusts at force 10 between 5 and 11 P.M.
- 29th. Light E. airs and calms throughout morning, and overcast and misty with falling snow. Fine and clear weather afterwards.
- 30th. Light S.E. and S.W. airs and calms. Misty around horizon, thickening in the afternoon. Heavy bank of black cloud to N.W. and W.
- May 1st. Fine and clear at 8 A.M., quickly clouding over, and became overcast at 10 A.M. from S.W., and continued overcast with thick mist and fog throughout.
Light to fresh and moderate S.W. wind till noon. Fresh E. wind at 4 P.M., increasing to moderate and fresh gale. Snow driving hard and thickly.
- 2nd. Moderate S.W. gale at 7 A.M. Strong wind at 11 A.M. Moderate W. gale at 2 P.M., decreasing to fresh breeze at 7 P.M. At midnight moderate S.W. gale. Overcast and misty with fiercely driving snow and thickly falling sleet until noon; clearing at 3.30 P.M., and becoming again overcast and misty at 8 P.M.
- 3rd. Fresh to moderate E. wind from 9 A.M. till noon. Then a fresh E.N.E. wind. Overcast, misty, foggy weather with falling snow throughout.
- 4th. From 8 A.M. to 4 P.M. gentle to moderate N.E. and N.N.E. winds. At 6 P.M. moderate N.W. gale. At 10 P.M. moderate to fresh W. gale. Overcast, cloudy weather throughout. Cleared at 8 P.M.
- 5th. Calm, cloudless, fine, very clear weather until 10 P.M. Light S.E. airs at midnight.
- 6th. Light N.W. airs and light to moderate N.N.E. winds. Clear weather throughout.

- 7th. Fresh to strong, moderate and light N.N.E. winds.
Fine, clear weather until 2 P.M., then misty.
- 8th. Calm, overcast, and misty throughout.
- 9th. Light airs and calms throughout. Fine but cloudy and misty generally.
- 10th. Calms and light E. airs till 6 P.M. with fine but misty weather. At midnight moderate S.E. gale and gloomy weather.
- 11th. Fresh to strong and fresh S.E. gale throughout. Fine and clear weather overhead, with cumulus and cirrus clouds.
Thick driving snow lower down with nimbus clouds around the horizon. From 8 A.M. throughout overcast with thick falling snow, which was very fine and wet.
- 12th. The gale moderate to force 7 at 7.30 A.M., and at 8 A.M. increased again to force 8. At noon the wind E. force 7. At 4 and 8 P.M. fresh N.N.E. wind, overcast with thick snow till noon. At 4 P.M. fine but misty. At 8 P.M. fine and clear. Snow very fine and wet.

APPENDIX

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TEMPERATURES TAKEN ON SLEDGE JOURNEY NORTH

FROM APRIL 16TH TO MAY 13TH, 1896

Fahrenheit.

Date.	Time.	Hourly.	Maximum.	Minimum.	Remarks.
April		°	°	°	
16	11.30 P.M.	1			
17	11 A.M.	- 1			
	11.30 P.M.	- 10			
18	11 A.M.	- 5	- 5	- 15	
	5 P.M.	- 12			
	MIDNIGHT	- 20			
19	NOON	4	4	- 22	
20	4 A.M.	- 17.5			
	4 P.M.	- 8	- 6	- 19.5	
	MIDNIGHT	- 14			
21	NOON	- 2			
	MIDNIGHT	- 9			
22	NOON	9	9	- 9	
	7 P.M.	8.5			
	MIDNIGHT	8			
23	10 A.M.	7	11	- 7	
	2 P.M.	7			
	5 P.M.	7			
	7 P.M.	4			
	11 P.M.	2			
24	7 P.M.	4			<p>All hourly temperatures taken with a swing thermometer supplied by the Meteorological Office.</p> <p>The maximum and minimum with Carey's case thermometers.</p>
	11 A.M.	2			
	5 P.M.	0			
	7 P.M.	- 2			
	MIDNIGHT	- 10			
25	10 A.M.	- 12			
	NOON	- 10			
	6 P.M.	- 12			
	MIDNIGHT	- 19			
26	NOON	- 14	- 11	- 21	
	4 P.M.	- 11			
	MIDNIGHT	- 19			
27	NOON	- 5	- 3	- 26	
	4 P.M.	- 2			
	8 P.M.	- 7			
28	4 A.M.	12.5			
	4 P.M.	23.5			
	8 P.M.	24			
	MIDNIGHT	21			
29	11 A.M.	27	27	4	
	2.30 P.M.	24			
	8 P.M.	7			
	MIDNIGHT	2			
30	9 A.M.	2	10	2	
	NOON	8			
	4 P.M.	8			
	8 P.M.	2			
	MIDNIGHT	- 6			

TEMPERATURES—*continued*

Date.	Time.	Hourly.	Maximum.	Minimum.	Remarks.
May		°	°	°	
1	9 A.M.	10	12	- 9	
	NOON	15			
	4 P.M.	14			
	8 P.M.	19			
	MIDNIGHT	19			
2	7 A.M.	31			
	11 A.M.	34			
	2 P.M.	32			
	5 P.M.	21			
	7 P.M.	14.5			
	MIDNIGHT	19			
3	9 A.M.	26			
	NOON	28.5			
	4 P.M.	28.5			
	8 P.M.	22			
4	8 A.M.	11	24	13	
	NOON	16			
	4 P.M.	15			
	6 P.M.	4			
	10 P.M.	2			
5	4 A.M.	- 3			
	2 P.M.	10			
	4 P.M.	12			
	8 P.M.	0			
	MIDNIGHT	- 10			
6	4 A.M.	- 8			
	2 P.M.	5	7	- 10	
	6 P.M.	4			
	10 P.M.	4			
7	2 A.M.	1			
	5 A.M.	2			
	2 P.M.	6	10	- 1	
	8 P.M.	6			
	MIDNIGHT	2			
8	8 A.M.	6			
	4 P.M.	18	19	6	
	8 P.M.	14			
	MIDNIGHT	7			
9	8 A.M.	21			
	4 P.M.	16			
	8 P.M.	10			
	MIDNIGHT	6			
10	4 A.M.	7			
	NOON	15			
	6 P.M.	9	17	7	
	MIDNIGHT	9			
11	4 A.M.	12			
	8 A.M.	15			
	6 P.M.	13			
	MIDNIGHT	13			
12	8 A.M.	14			
	NOON	15			
	4 P.M.	20			
	8 P.M.	14			

All hourly temperatures taken with a swing thermometer supplied by the Meteorological Office.

The maximum and minimum with Carey's case thermometers.

The zoological collection promises to be very interesting, but at present it is difficult to say much, since the work of assorting and that of identification is not yet complete. I have received no report yet on the smaller life of Franz Josef Land Archipelago. I have, however, received the following information; but any list is merely provisional. The collection chiefly consists of smaller vertebrate and invertebrate forms. Richest of all will perhaps be the micro-organisms, upon which a considerable time was spent all through the winter months, many specimens having been drawn from living or freshly mounted preparations.

Among Protozoa, the Infusoria are well represented. There are sponges and collenterates, the latter including several interesting corals. Worms are rich in the number of species, and include sipunculids, Rotifers, Polyzoa, leeches, chactopods, nematodes, &c. Sea urchins and brittle stars were very plentiful, and the collection also includes several starfish, sea-cucumbers, and feather-stars. The sea-cucumbers were mostly obtained from the stomachs of walruses, in which were also found the interesting worm known as *Priapulius* and various molluscs. Crustaciæ were obtained in large numbers; insects are but poorly represented by three or four species. There are no moths or butterflies. Five or six species of acarina and spiders were obtained; sea-spiders or pycnoyonida are well represented. To this invertebrate list has to be added a considerable number of bivalves and gasteropods. Among vertebrate, sea-quirts, appendicularia, and probably four species of fish complete the series, apart from birds and mammals. The collection is mostly marine, and was obtained from all depths down to 243 fathoms; the greater proportion, however, consists of animals obtained near the shore at depths varying down to eighteen and twenty-six fathoms. The interesting discovery of bones of walrus, cetaceans, and deer on the gigantic raised beaches will be dealt with by the geologist.

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